Towards an Economic Valuation of the Hauraki Gulf: The Finding of an Eco-Cluster?

Project: Total Economic Valuation of the Hauraki Gulf

Phase One Report

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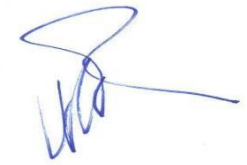

Jean-Pierre de Raad, Chief Executive, NZIER

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Executive Summary

This report summarises the results of the first phase of the investigation on the total economic valuation of the Hauraki Gulf, a multi-phase research project presented to and endorsed by the Hauraki Gulf Forum Officers in October 2011.

The project's phase one has:

- identified the environmental and economic benefits provided by the Hauraki Gulf
- identified and built a relationship with key stakeholders, partners and knowledge holders
- reviewed the existing studies and summarised the available methodologies and results
- identified gaps and suggested new research directions
- produced a general view of the economic value of the Hauraki Gulf, specifying values and methodologies for each identified benefit.

The Hauraki Gulf is a complex ecological and geographical feature providing a wide range of environmental benefits (e.g. shelter, food) which have attracted human settlers since the beginning of the colonisation of Aotearoa-New Zealand. As a result, today the Gulf represents one of Auckland's most important environmental, economic, social and cultural assets, and the most important marine asset for the Waikato region. However, the state of the Hauraki Gulf environment shows clear symptoms of depletion and degradation.[1]

The Hauraki Gulf contains 1.2 million hectares of ocean and 30 major island groups. Many are important nature reserves, some in close proximity to the city. It retains productive fishing areas, borders 13 regional parks, contains six marine reserves, and supports populations of resident whales and dolphins as well as internationally significant seabird and migratory shorebird populations.

The Hauraki Gulf is not only a place where a number of economic, social, environmental, cultural, recreational and public activities take place; it also defines the very identity of the communities who live on its shores and is a crucial place for cultural iwi values.

The Hauraki Gulf shelters New Zealand's biggest commercial harbour and hosts the main New Zealand naval base as well as many smaller ports and numerous marinas. Around its shores lies New Zealand's largest metropolitan area, as well one of the country's main tourist attractions: the Coromandel Peninsula.

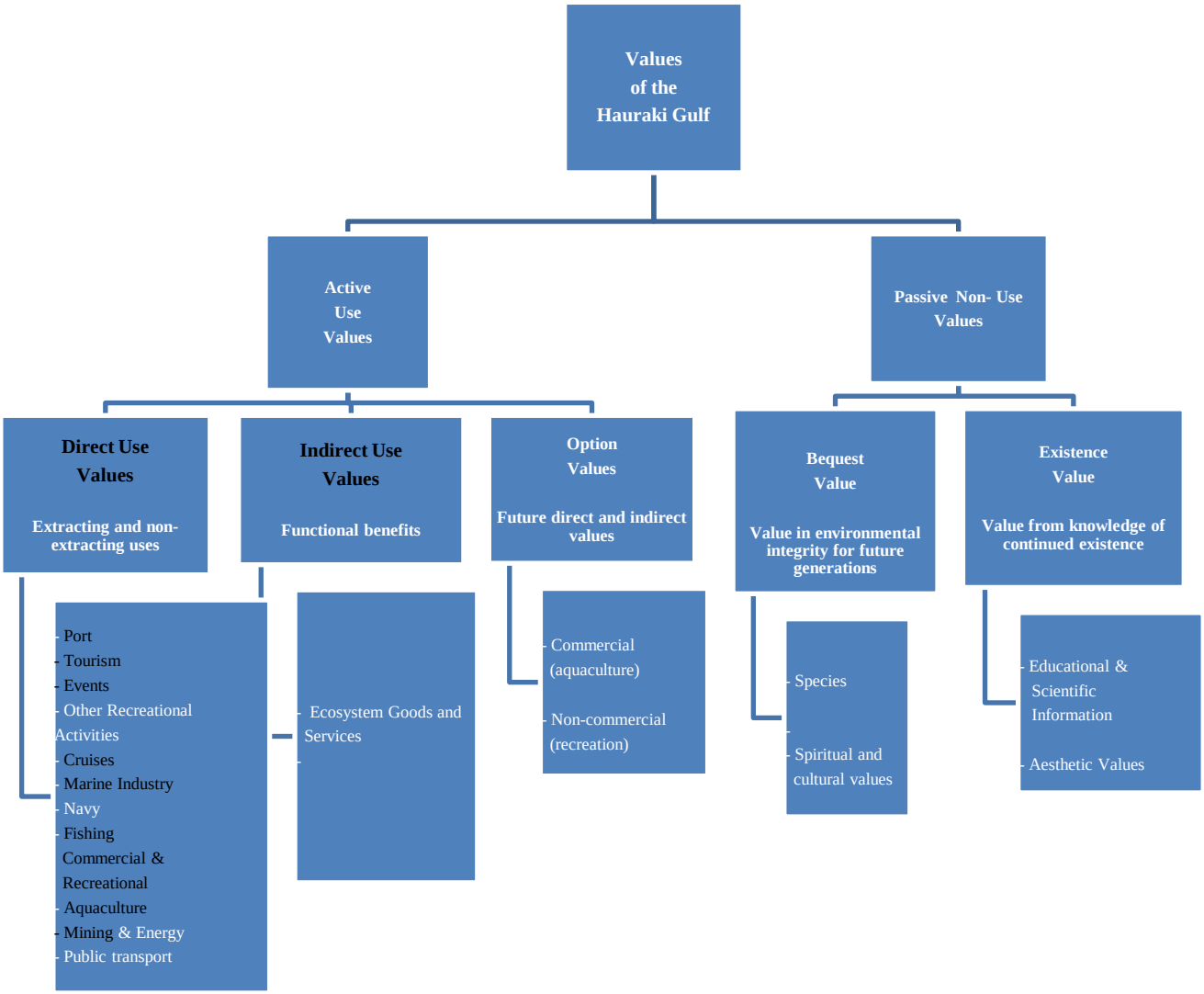
All these activities and features generate a vast and constant flow of benefits for human beings. Some of these benefits are the product of activities that are part of commercial markets, others are ecological benefits that are accounted for – or not accounted for (externalities) – by commercial markets and could be classified as intermediate (e.g. waste treatment) or final products (e.g. fish); others are values which do not form part of any commercial market.

Emerging literature highlights the complex benefits obtained from a physical space and place. The total economic value (TEV) is a framework for organising different classes of value and is usually applied in the field of cost-benefit analysis. In the context of this research it is intended only as a framework to organise and eventually qualify or quantify the values provided by the Hauraki Gulf. Figure 1 provides a tentative application of the TEV framework to the Hauraki Gulf, where the values investigated in this project's first

[1] Hauraki Gulf Forum, 2011.

phase have been highlighted (please refer to section 2 of the report for a detailed explanation of value categories). Focusing on the utility of an ecosystem, the total economic value (TEV) incorporates both market and non-market values, and not just the exchange value of natural resources that are traded in the market place. However, the focus of this report is only on economic values/activities, a choice that represents a starting point of the exploratory process towards a total economic valuation of the Hauraki Gulf.

Figure 1. The total economic value of the Hauraki Gulf (tentative)



Policy goals or scenario design are out of the scope of this project. Future research could, however, investigate and develop scenarios. Therefore, the report does not make any policy recommendations, nor attempts to describe scenarios or trade-offs.

The economic values in the report were assessed mainly through a stocktake of existing studies and by focusing on their impact on the economic activity (i.e. contribution to Gross Domestic Product). The sectors were identified by considering their interaction with the Hauraki Gulf and through a tentative understanding of the benefit they derive from the ecological goods and services it generates. The report

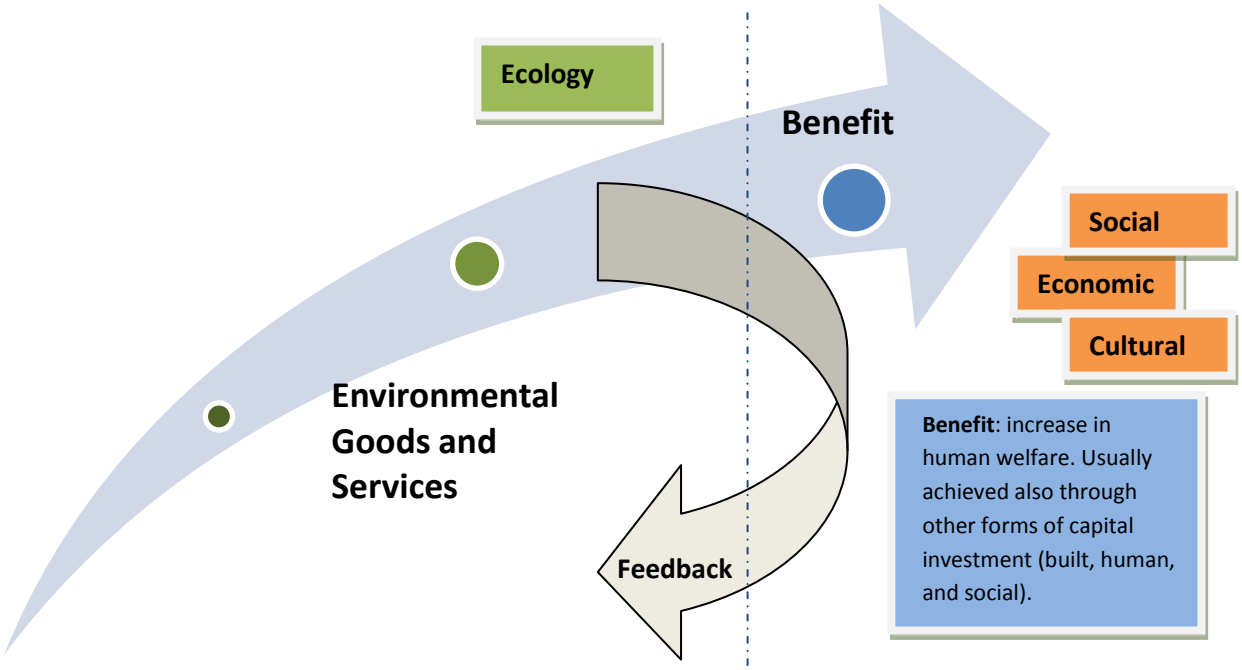
does not aim to achieve an exhaustive discussion in this area, or to determine a preferred approach; its goal is to provide some ideas and evidence useful for the discussion on how to proceed from here.

The next phase of the project will lead to the re-scoping of the project plan and include feedback from the Hauraki Gulf Forum and stakeholders.

The link between the environment and the economy is complex and it is still characterised by vast theoretical and methodological uncharted territories. This report represents a first attempt to set the stage for a debate.

After defining the goods and services provided by the Hauraki Gulf ecosystem[2] we propose a pathway (Figure 2) to relate them to the various benefits and activities identified as contributors to the economy .

Figure 2. Ecosystem pathways and economic benefits



A **benefit** is realised at the point where human welfare is directly affected and where usually other forms of capital (built, human and social) are needed to realise the gain in welfare[3]. Furthermore, different activities have different environmental impacts (**feedback**) on the environment; some activities are relatively neutral, while others have high negative impacts, ongoing or potential (e.g. a major shipping disaster in the Hauraki Gulf). This pathway allows us to highlight how the environmental goods and services provided by the Hauraki Gulf underpin the assessed economic benefits (Table A and Table B).

[2] Please see Section 3 for a detailed description.
[3] For example, clean water provision is a service for fishing, and clean water for swimming is a benefit (requiring travel costs, etc.).

Table A. Ecosystem goods & services and activities in the Hauraki Gulf : fishing, aquaculture, recreational activities, property and public amenities

Environmental Goods and Services[4]	Benefits	Feedback
• Supporting goods & services • Regulating goods & services • Provisioning goods & services • Cultural goods & services	commercial fishing	extractive[5]
	aquaculture	non-extractive but invasive[6] and exclusive
	recreational fishing	partially non-extractive[7]
	• recreational (non-extractive) (*) • social • cultural • property values • public amenities	non-extractive

Notes: (*) Includes tourism, events, marine reserves, boating, recreational marine industry, cruise industry

This schematisation is useful to highlight how the economy and the environment are intimately intertwined[8] by displaying how the many different sets of ecological goods and services contribute to the realisation of the human benefits associated with those activities, which in turn have different feedbacks on the environment.

[4] See Table 2.
[5] **Extractive** refers to the fact that an activity extracts from the environment a natural resource (e.g. fish, sand).
[6] **Invasive and exclusive** in this context is intended as a characteristic of an activity to occupy the marine space in an exclusive and permanent way that is not allowing its use by other activities (e.g. marinas, aquaculture farms).
[7] **Partially non extractive** as recreational fishers value not only the catch, but also by the "experience", and increasingly –as signalled by the Ministry of Primary Industries, they practice catch and release.
[8] For example, they show that fishing's reliance on fish availability relates not just to the provision of biomass, but is supported by a complex and intertwined set of other ecological goods and services that are often treated as a hidden input which is not factored in the economic valuation. This implies that often those "hidden" goods and services are disregarded in the market space (in economic terms they are externalities) and could be overexploited leading to environmental degradation and widespread environmental and economic damage.

Table B. Ecosystem goods & services and activities in the Hauraki Gulf: Port, Transport, Navy and Mining

Environmental Goods and Services		Benefits	Feedback
• Physical structure	Shoreline and storm protection	port transport navy	partially extractive (dredging) [9] invasive and exclusive
• Exhaustible resources	Minerals and sand	mining	extractive, invasive and exclusive

At a first glance, the main difference between the two groups of activities included in the two tables, is that the first ones (Table A) are mainly related to renewable ecosystem goods and services, while port and mining depend, respectively, on the physical infrastructure and non renewable resources provided by the environment. This could imply that the latter do not see the ecological quality as a critical factor of their business model, or "value proposition"[10] as it is often referred to in the business community. Conversely, the activities grouped in Table A share a common interest in protecting the environment, obviously with different emphasis and perspectives, as they consider the flow of ecological goods and services as a crucial input of their economic activity and at the very core of their value proposition.

Further, economic activities differ also in terms of their feedback on the environment. This schematisation provides some hints in this direction. For example, some are extractive activities, as for fishing, but less so for recreational fishing as it also realises benefits from recreational aspects not strictly related to the catch; other activities are non extractive but invasive and exclusive as they occupy a certain area and prevent other activities/benefits to be realised there, as for example in the case of aquaculture, marinas and port.

This complex web of relationships, which needs to be further explored in the future, underlines the economy's dependence on the environment and underpins the economic assessment that have been the object of the report's economic valuation of the identified activities, and estimated in terms of contribution to the Gross Domestic Product (GDP)[11].

The activities that the report analyses in detail are:

- Port
- Cruise industry
- Recreational marine sector, marinas and moorings
- Aquaculture
- Fishing – commercial, recreational and customary

[9] Dredging is classified as **partially extractive** as it is not a continuous activity.
[10] A value proposition can be defined as a promise of value to be delivered by a firm and the corresponding belief from the customer that value will be experienced.
[11] Therefore this has not to be interpreted as a cost-benefit analysis exercise nor judged as an attempt to measure natural capital.

- Tourism
- Events
- Marine reserves, and
- Mining.

Each section contains a brief introduction about the qualitative characteristics of the particular benefit or activity, a description of the methodology adopted to assess their economic contribution, and the tentative results obtained by its application. Given all the theoretical, methodological, ecological and economical layers of complexities involved, it is important to bear in mind that the preliminary results have not to be interpreted as conclusions. Therefore, the values presented (Table C) are not consistent as they do not refer to the same year, present various inconsistencies, are the result of different valuation techniques, assumptions and are often not mutually exclusive. Despite these limitations, these assessed values represent an evidence-based quantitative valuation of the economic activity related to the Hauraki Gulf.

Bearing in mind these caveats, it is nonetheless interesting to consider the preliminary results obtained by assessing only the direct interaction between the economy and the Gulf[12].

Table C. Assessed economic activities in the Hauraki Gulf[13]

	Year	Direct Value Added $2011million (1)	Indirect + Induced Value Added $2011million (1)	Total Value Added $2011million (1)	Employment (2)	
Tourism	2008	656	281	**937**	15,742	FTEs
Marine Recreational	2008	n.a.	n.a.	**550**	5,781	FTEs
Recreational Fishing	2010	n.a.	n.a.	**81**	n.a	
Aquaculture (3)	2008/2010	49	50	**99**	939	FTEs
Commercial Fishing (4)	2010	41	n.a.	**41**	1,183	FTEs
Ports of Auckland	2008	113	143	**257**	2,027	ECs
Cruise Industry	2009	35	34	**69**	928	ECs
Sand Mining	2010	n.a.	n.a.	**10**	100	FTEs

Notes: **(1)** •direct impacts: initial injections of revenue and expenditure that accrue to that specific sector; •indirect impacts: net increase of economic activity generated by the provision of goods and services to the 'study sector', and •induced impacts: net increase of economic activity due to increased household expenditure in the 'study sector' (see also section 2.2.1). **(2)** FTEs: Full time equivalents, ECs Employment Counts, as defined by Statistics New Zealand. Employment counts are not directly comparable to Full-Time Equivalents (FTEs) as they count equally both full- and part-time jobs. Therefore, they tend to be higher than FTEs. **(3)** Values for Auckland refer to 2008, for Waikato to 2010. **(4)** Including processing.

[12] To provide a broader picture (to which all the mentioned caveats apply as well), also employment generation assessments have been included.

[13] All values include Auckland and the rest of the Hauraki Gulf.

It can be observed that the major contributor is tourism, followed by the recreational marine cluster, the Ports of Auckland, commercial fishing and aquaculture, recreational fishing and the cruise industry.

Considering that tourism's contribution only accounts for non-residents (foreigners or other nationals) and that almost 35% of the New Zealand's population resides around the Hauraki Gulf, it is clear that this value, though big, is likely to be underestimated as it excludes tourism expenditure of the Hauraki Gulf residents.

From another perspective, the vast majority of the assessed economic values relate to recreational activities – and this is despite residents' benefits having been largely ignored.

From a holistic and ecological perspective, these preliminary results highlight that the Hauraki Gulf's economic activity is only minimally the result of an algebraic sum of competing values or a space where the focus has to be on conflicts and trade-offs.

The picture provided by this exercise, though tentative, shows that not only does the environment underpin all the values realised by humans, but that the relationship between the economy and the environment in the Hauraki Gulf is mainly a synergic one. This means that a thriving ecosystem is necessary to support the economy and a thriving economy is not only compatible with an improved state of the environment, but is a necessary condition to realise the vast untapped economic potential of the Hauraki Gulf.

These preliminary results highlight that the Hauraki Gulf is home to a cluster of economic activities that have the environment at the very core of their value proposition and share a common interest in protecting the environment as they depend critically on the flow of ecological goods and services provided by the Gulf. These economic activities could increase their value by collaborating more with each other. Therefore, they could be defined as an eco-cluster[14].

The Hauraki Gulf has always been the most powerful economic, environmental, social and cultural cluster for Auckland and the Coromandel and its economic relevance could grow if its ecosystems are preserved and the potential of an eco-Hauraki Cluster is clearly identified both by private and public actors.

If we consider that the indentified gaps refer mainly to other recreational, social and cultural values sets, this preliminary conclusion is reinforced and the vision of the Hauraki Gulf as an eco-cluster of values is even brighter.

[14] A clearer specification of this eco-cluster will be the object of the second phase of this research project. Michael Porter's definition of a cluster is (Porter, 1998): " geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (for example universities, standard agencies, and trade associations) in particular fields that compete but also cooperate". He also points out: "a cluster is a form of network that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions". Therefore, being the Hauraki Gulf, its environment and ecosystem goods and services, the "geographic location" of this cluster, we decided to qualify it as an eco-cluster.

In order to set the stage for the re-scoping of the project before launching its second phase, main gaps (the unknowns) have been identified (Table D), some of which could included in future investigation.

Some of those values are partially known and could be explored through methodologies (GDP contribution) similar to those already adopted. They are: Boating, Marinas, Transport/Ferries, the Naval Base in Devonport, Marine Reserves, Mining and the impact of the Hauraki Gulf on property values (which was briefly treated).

Table D. List of known and unknown benefits provided by the Hauraki Gulf

Knowns	Partially unknown As already captured by some of the recreational knowns	Unknowns/ Gaps

• Port
• Cruise Industry
• Recreational Marine Industry
• Aquaculture
• Fishing :
  • commercial
  • recreational
  • customary (partially)
  •
•Tourism
• Events
	• Boating and other recreational activities[15]
	• Marinas
	• Transport/Ferries[16]
	• Property values[17]
	• Marine Reserves
	• Mining
		• Navy
		• Environmental goods and services not yet accounted for
		Out of the Scope of Phase 1
		• Option values
		• Existence values
		• Bequest Values
		• Cultural values
		• Social values
		• Spiritual values

[15] E.g. surfing.

[16] The economic impact on transport ferries in the Hauraki Gulf is already captured by the tourism and cruise ships values. However, commuting transport flows are not included and quantified. In 2011 there were approximately 2 million passengers who commute by ferry every year in Auckland (Auckland Transport) and there is increasing interest in expanding capacity.

[17] Impact of view and proximity to the sea has been estimated.

Another area where more research is recommended is the one related to the valuation of ecological goods and services. The report has shed some light and started the exploration and discussion of some relevant aspects, but more detailed understanding of the ecological dynamics of the Gulf and of their relation with the economy is needed. Further, the relationship with agricultures sectors, such as dairying, horticulture and viticulture could be considered.

Others, such as cultural, social, spiritual values were out of the scope of this first phase as the valuation perspective was strictly economical. This “reductionist” approach is a starting point as we are aware of the numerous other values sets that maybe associated with the Hauraki Gulf. However, the inclusion of those value sets is likely to reinforce the vision of the Hauraki Gulf as an eco-cluster of values, not to contradict it.

Finally, some unknowns could be simply unknown to us.

Purpose, Scope, Structure and Limitations of the Report

This report summarises the results of the first phase of the investigation on the total economic valuation of the Hauraki Gulf (see section 1.1), a multi-phase research project (described in section 1.2)[18].

This report describes the results of the project's phase one, namely, to:

- identify the environmental and economic benefits provided by the Hauraki Gulf
- identify and build a relationship with key stakeholders, partners and knowledge holders
- review the existing studies and summarise the available methodologies and results
- produce a general view of the economic value of the Hauraki Gulf, specifying, for each identified benefit, which values/methodologies are known and applicable and which are unknown, outdated or obtained through weak methodologies.

The focus of this report is on economic values/activities relating to direct use. However, the intention is not to deny the existence of other value sets (e.g. cultural, spiritual and social, which are sometimes mentioned in the methodological section); instead, it simply represents a starting point of the exploratory process towards a total economic valuation of the Hauraki Gulf.

The economic values in the report were assessed mainly through a stocktake of existing studies and by focusing on their impact on the economic activity (i.e. contribution to Gross Domestic Product arising from its commercial use value - apart from recreational fishing which uses willingness to pay). The sectors were identified by considering their interaction with the Hauraki Gulf and through a tentative understanding of the benefit they derive from the ecological goods and services it generates.

The project focuses on the HG's economic benefits/values and on the available methodologies to produce their total economic valuation. Policy goals or scenario design are out of the scope of this project. Future research could, however, investigate and develop scenarios. Therefore, the report does not make any policy recommendation, nor attempts to describe scenarios or trade-offs.

In order to put the stocktake of the identified economic values into context, some theoretical and methodological issues are introduced as well in Section 2 of the report. Some aspects of the Total Economic Value Framework are examined. The report does not aim to achieve an exhaustive discussion in this area, or to determine a preferred approach; its goal is to provide some ideas and evidence useful for the discussion on how to proceed from here.

The next phase of the project will lead to the re-scoping of the project plan and include feedback from the Hauraki Gulf Forum and stakeholders.

The second phase will:

- re-scope the project, based on the results of phase 1 and feedback from stakeholders
- identify which of the "unknowns" should be investigated and by whom (e.g. Council, Hauraki Gulf Forum, Stakeholder, Contractors) and quantify the resources needed

Which could be followed by the:

- production of a valuation of the "unknowns"
- report summarising the total economic value of the HGMP, expressed in monetary terms where possible and appropriate.

[18] The project plan was reviewed with the Hauraki Gulf Forum Technical Officers Group in October 2011.

The link between the environment and the economy is complex and it is still characterised by vast theoretical and methodological uncharted territories. Section 3 of the report represents a first attempt to set the stage for a debate by, firstly, defining the goods and services provided by the Hauraki Gulf ecosystem, and then relating them to the various benefits and activities identified as contributors to the economy. Again, it is not intended to reach any conclusion, but rather to ignite a debate.

The focus of the report then moves more directly to the economic valuation of the activities that have been identified, and estimates that in terms of contribution to the Gross Domestic Product (GDP). Therefore this has not to be interpreted as a cost-benefit analysis exercise nor judged as an attempt to measure natural capital. The preliminary results are summarised in section 4; however, it is important to bear in mind that these results have not to be interpreted as conclusions and the values presented are not consistent as they do not refer to the same year, present various inconsistencies, are the result of different valuations techniques, assumptions and are often not mutually exclusive. Despite these limitations, these assessed values represent an evidence-based quantitative valuation of the economic activity related to the Hauraki Gulf.

The identification of the gaps (the unknowns) refers to the scope of the analysis. Again, other value sets are not directly considered in this report only because they are out of the scope of the first phase. However, the re-scoping of the project could determine the inclusion of a wider set of values.

Finally, individual sections for each of the activities are presented. Each section contains a brief introduction about the qualitative characteristics of the particular benefit or activity, a description of the methodology adopted to assess their economic contribution, and the tentative results obtained by its application.

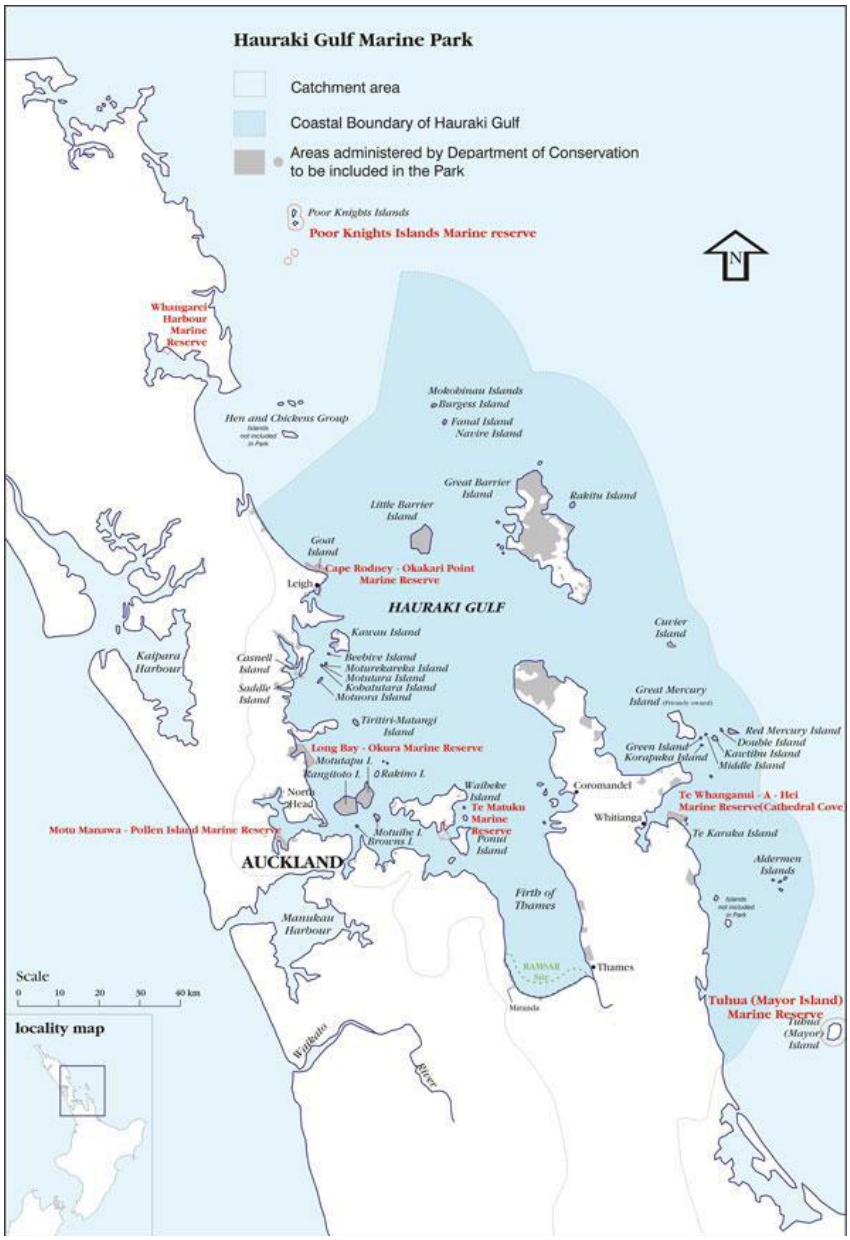
The benefits and activities analysed in detail are:

- Port (section 5)
- Cruise industry (section 6)
- Recreational marine sector, marinas and moorings (section 7)
- Aquaculture (section 8)
- Fishing – commercial, recreational and customary (section 9)
- Tourism (section 10)
- Events (section 11)
- Marine reserves (section 12), and
- Mining (section 13).

1. Introduction: The Hauraki Gulf and its Economic Valuation Project

The Hauraki Gulf is a complex ecological and geographical feature providing a wide range of environmental benefits (e.g. shelter, food) which have attracted human settlers since the beginning of the colonisation of Aotearoa-New Zealand. As a result, today the Gulf represents one of Auckland's most important environmental, economic, social and cultural asset, and the most important marine asset for the Waikato region. However, the state the Hauraki Gulf environment shows clear symptoms of depletion and degradation.[19]

Figure 3. The Hauraki Gulf and its Marine Park



[19] Hauraki Gulf Forum, 2011.

The Hauraki Gulf contains 1.2 million hectares of ocean and 30 major island groups. Many are important nature reserves, some in close proximity to the city. It retains productive fishing areas, borders 13 regional parks, contains six marine reserves, and supports populations of resident whales and dolphins as well as internationally significant seabird and migratory shorebird populations.

The Hauraki Gulf is not only a place where a number of economic, social, environmental, cultural, recreational and public activities take place; it also defines the very identity of the communities who live on its shores and is a crucial place for cultural iwi values.

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All these activities and features generate a vast and constant flow of benefits for human beings. Some of these benefits are the product of activities that are part of commercial markets, other are ecological benefits that are accounted for – or not accounted for (externalities) – by commercial markets and could be classified as intermediate (e.g. waste treatment) or final products (e.g. fish); others are values which do not form part of any commercial market.

1.1 The Hauraki Gulf Marine Park Act and the Hauraki Gulf Forum

The Hauraki Gulf Marine Park Act was passed in 2000, in recognition of the unique importance of the Gulf. The main purposes of the Act were to:

- integrate the management of the natural, historic and physical resources of the Hauraki Gulf, its islands and catchments
- establish the Hauraki Gulf Marine Park
- establish objectives for the management of the Hauraki Gulf, its islands and catchments
- recognise the historic, traditional, cultural and spiritual relationship of the tangata whenua with the Hauraki Gulf and its islands, and
- establish the Hauraki Gulf Forum[20].

The **Hauraki Gulf Forum** comprises:[21]

- representatives of the Ministers of Conservation, Fisheries, and Maori Affairs
- six representatives of the tangata whenua of the Hauraki Gulf and its islands (appointed by the Minister of Conservation after consultation with the tangata whenua and the Minister of Maori Affairs)
- seven representatives from the Auckland Council, including one member of each of the Great Barrier Island and Waiheke Island local boards, and
- representatives of the Hauraki District Council, Matamata-Piako District Council, Thames-Coromandel District Council, Waikato District Council and Waikato Regional Council.

The Forum has appointed the Auckland Council as its administering authority.

The Forum has the following purposes:

[20] The Forum has a range of functions and powers, identified under the Hauraki Gulf Marine Park Act, which include: considering issues, receiving reports, making recommendations and commissioning activities.
[21] www.haurakigulfforum.org.nz

- To integrate the management and, where appropriate, promote the conservation and management in a sustainable manner, of the natural, historic, and physical resources of the Hauraki Gulf, its islands and catchments, for the benefit and enjoyment of the people and communities of the Gulf and New Zealand.
- To facilitate communication, co-operation, and co-ordination on matters relating to the statutory functions of the constituent parties in relation to the Hauraki Gulf, its islands and catchments, and the Forum.
- To recognise the historic, traditional, cultural and spiritual relationship of tangata whenua with the Hauraki Gulf, its islands and, where appropriate, its catchments.

The Hauraki Gulf Forum is required to prepare and publish, once every three years, a report on the state of the environment in the Hauraki Gulf, including information on progress towards integrated management and responses to prioritised, strategic issues.

Its 2011 assessment noted the Gulf has undergone an incredible transformation over two human lifespan. That transformation is continuing in the sea and around the coast, with most environmental indicators either showing negative trends or remaining at levels which are indicative of poor environmental condition.

The Forum has developed a vision for the Hauraki Gulf which refers to a place which is “celebrated and treasured”, which is “thriving with fish, shellfish, kaimona”, which has a “rich diversity of life” and which supports a “sense of place, connection and identity” and a “vibrant economy”.

The preparation of this first phase report on establishing a Total Economic Valuation of the Hauraki Gulf responds to interest in identifying and analysing:

- the benefits people currently receive from the Hauraki Gulf, and
- the potential economic impacts and benefits which would be realised from an improved environment and a policy framework.

Some empirical research has already been undertaken to understand and quantify some of the Hauraki Gulf economic and environmental benefits and values, but mainly in isolation and without taking into account trade-offs and interactions.

1.2 The Economic Valuation Project

As a result of these concerns, the Auckland Council has launched a research project to determine the economic value of the Hauraki Gulf (HG).

The overall goal of this project is to identify the benefits provided by the Hauraki Gulf and embark on a process of economic valuation. The project reviews existing literature and studies on numerous aspects of the Hauraki Gulf, identifying current gaps in knowledge. There is not an intention to monetise all the values embedded in the Hauraki Gulf, as many values cannot be monetised, such as spiritual values which vary dramatically from one person to another.

This total economic valuation exercise will:

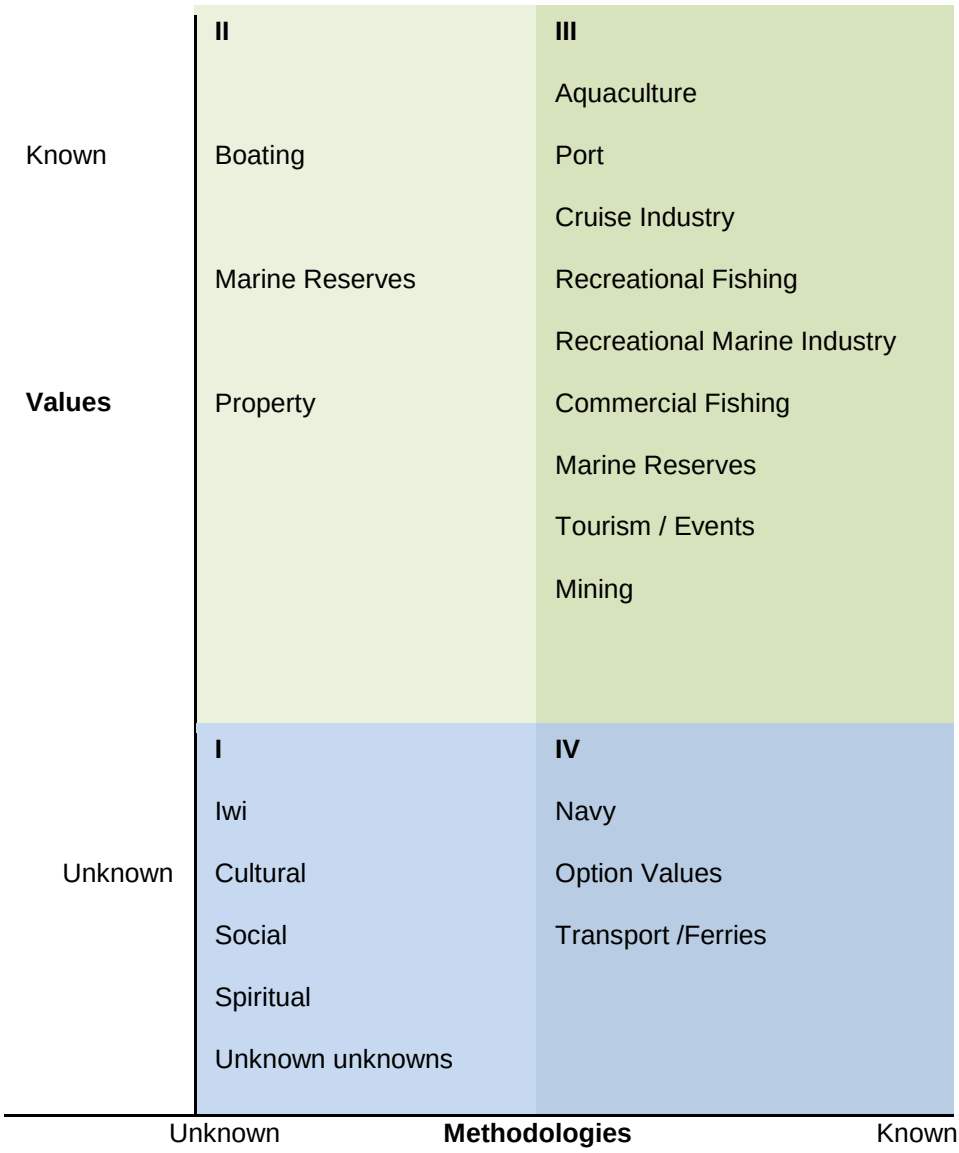
- affirm the economic relevance of the Hauraki Gulf being the result of multiple values (economic, cultural, social and environmental)
- recognise the relative importance of the different actors and benefits
- highlight the network that interrelates these values
- contribute to the inter-agency planning process for the Hauraki Gulf, and
- assess strategic options and policy changes.

In its **first phase**, the project has:

- identified the economic benefits provided by the Hauraki Gulf
- identified and developed relationships with key stakeholders, partners and knowledge holders
- reviewed the existing studies and summarised the available methodologies and results, and
- produced a view of some economic values of the HGMP, specifying for each identified benefit and activity which values and methodologies are known and applicable and which are unknown, outdated or obtained through weak methodologies.

Figure 4 shows a matrix of the values of the Hauraki Gulf identified in this study. The values/activities are also related to their valuation methodology. This helps frame phase 1, providing a gap analysis in existing methods and measurement. The vertical axis represents the identified values, while the horizontal axis represents the methodologies used to assess those values. The project's first phase has assessed both the existence of value assessments and the validity of the methodologies used. Quadrant III, for example, represents the values already assessed; quadrant II groups identified activities for which an assessment methodology has not been identified yet; quadrant IV includes identified activities for which an assessment methodology has been identified but not yet applied.

Figure 4. Hauraki Gulf total economic valuation: current state of knowledge



The **second phase** of the project will:

- re-scope the project, based on the results of the first phase, and
- identify which of the ‘unknowns’ should be investigated and by whom (e.g. Auckland Council, Hauraki Gulf Forum, stakeholder, contractor), and quantify the resources needed.

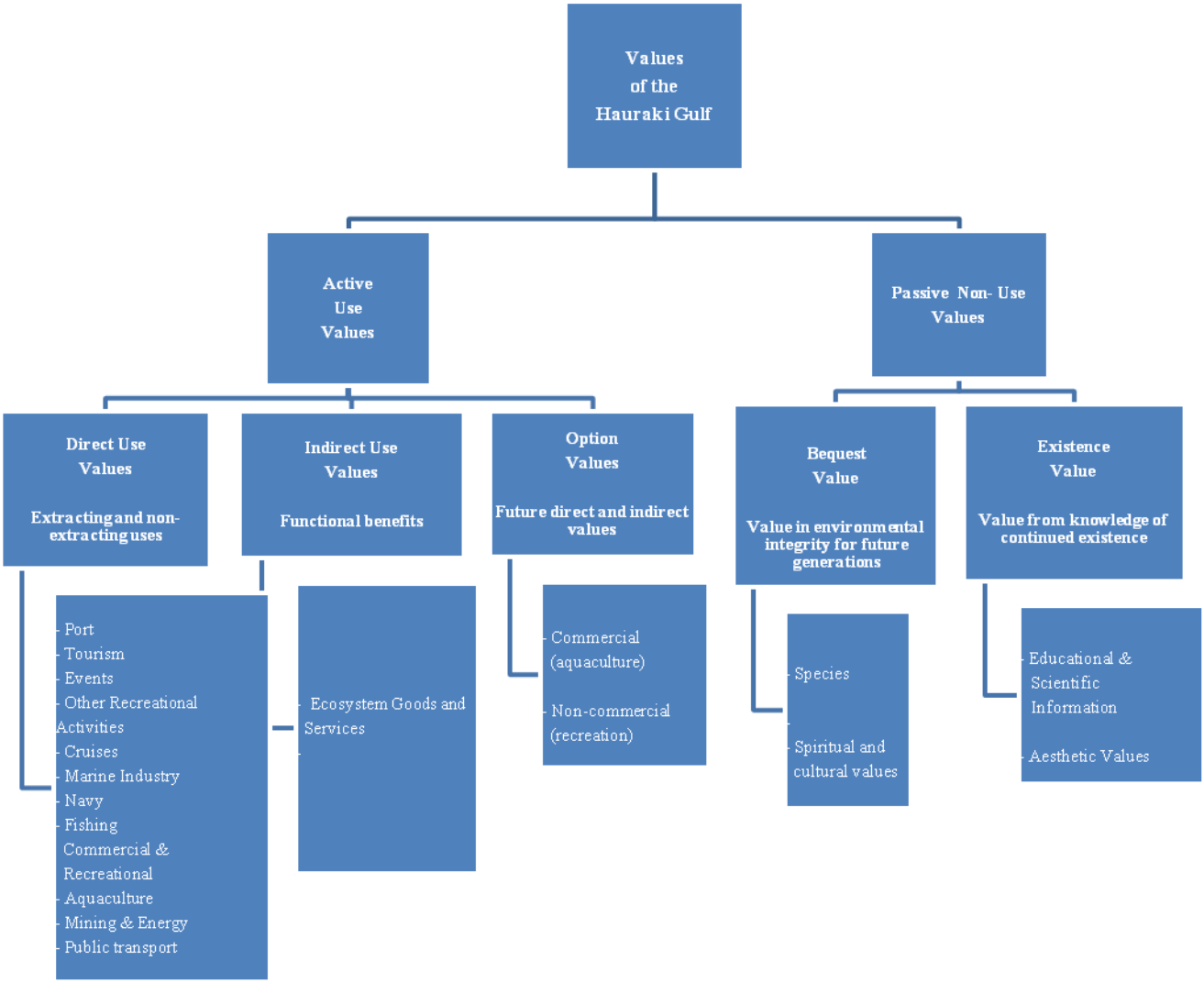
This will be followed by:

- the articulation of a valuation of the ‘unknowns’ which could be quantitative or qualitative,
- a report summarising the total economic value of the HG, expressed in monetary terms where possible and appropriate., and
- the final report.

2. The Total Economic Value Framework

Emerging literature highlights the complex benefits obtained from a physical space and place. These include economic, environmental, social and cultural. The total economic value, as illustrated in presented in Figure 5[22], is a framework for organising different classes of value that might be associated with the Hauraki Gulf and is usually applied in the field of cost-benefit analysis. In the context of this research it is intended only as a framework to organize and eventually qualify or quantify the values provided by the Hauraki Gulf.

Figure 5. The total economic value of the Hauraki Gulf (tentative)



Focusing on the utility of an ecosystem, the total economic value (TEV) incorporates both market and non-market values, and not just the exchange value of natural resources that are traded in the market place. These utilities range across a spectrum of values grouped as active use and passive use values. All values relate to benefits provided to human beings in different time and spatial frames.
As already stated, at this stage of the project, this framework has not yet been adopted and is presented with the aim of setting the stage on how other values, not strictly economic as those considered until now, could be identified and classified.

[22] This first phase has focused only on some direct and indirect use values.

Active use values are classified as direct use, indirect use and option values:

- *Direct use values* are consumptive and production related (e.g. fisheries, water supply). Most of them can be captured through market prices.
- *Indirect use values* are functional benefits that support or protect direct use activities (e.g. recreation, water retention, nutrient recycling). Some of those can be expressed in monetary terms and are market related.
- *Option values* relate to the benefits of preserving the natural resource for a potential future direct and indirect use (e.g. biodiversity as future source of medicines).

Passive use values are classified as:

- *bequest value* (e.g. preservation for future generations, including spiritual and cultural values), and
- *existence value* (e.g. aesthetic, habitat, biodiversity).

Despite the focus of this first phase has been only on some direct and indirect values, nonetheless applying a TEV framework to a vast and heterogeneous space like the Hauraki Gulf, poses a number of challenges and difficult choices. The next paragraphs will focus on some of them.

2.1 Prices and Values

Prices are often considered a synonym of values because, in a market economy, they represent the manifestation of individual and social economic preferences and the information they provide drives the individual and social allocation of scarce resources. . This is a process of monetisation reductionism using a common metric to compare relative value. In theory, it is a good process for static comparison but we acknowledge that in practice there are many methodological assumptions which cannot be ignored.

In economic theory there is no agreed explanation of what determines prices. After a long debate about the use value, the exchange value and the labour content, the theory of marginal utility has proposed a convincing answer.[23] Neoclassical economic theory asserts that in a market economy the market price is the result of the interaction between supply and demand: the price of a good or service reflects the equilibrium between the decreasing marginal utility of consumers and the increasing marginal cost of production of suppliers.

Although prices are the most useful indicators of economic values, their validity as decision tools is increasingly questioned as in reality goods and services are not homogeneous and prices are often distorted (which means they do not reflect 'real' marginal utilities and costs) by other factors such as market failures (e.g. externalities), tax and other government regulations.

Possibly, the most striking market failure relates to the environment and the increasing number of 'tragedy of the commons' that have characterised our recent history.[24] It is not until recently that modern societies and

[23] The most commonly quoted example to show the marginal utility explanatory force is the paradox of value (also known as the diamond–water paradox), which is the apparent contradiction that although water is essential for human beings survival and diamonds have very limited practical uses, diamonds command a higher price in the market. The debate over value theory has not yet produced an agreed conclusion, and marginal theory has been demonstrated to hold only under very unrealistic and strict conditions and to be affected by a tautological flaw. One of the most notable contributions to this long-lasting and still open debate is Sraffa, P., 1960. *Production of Commodities by Means of Commodities*. Cambridge University Press.

[24] This expression is derived from Hardin, Garrett, 1968. 'The Tragedy of the Commons', *Science*, 162. This essay described a dilemma arising from the situation in which multiple individuals, acting independently

economic theory have acknowledged the scarcity of an increasing number of natural resources, firstly, and then entire ecosystems. Until the end of the last century, few resources were devoted to the study of the environment and its ecosystems, while most environmental goods and services where considered infinite or pure public goods not to be priced. The increasing understanding of the enormous – and sometimes irreparable – negative externalities that economic activities have on the environment, together with a growing awareness of ecological phenomena and processes, is increasingly placing scarcity, and therefore value or price, at the core of the analysis of environmental goods and services, and underling the importance of development sustainability.

The growing understanding of the interactions between market activities and the environment is allowing a better understanding of externalities and of policy tools to address market failures. One relevant step in this direction is often, but not always, the pricing of non-market environmental goods and services, for which a number of calculation techniques have been devised. However, it is not always possible or meaningful to calculate non-market values or prices of ecosystems. Furthermore, there is emerging scientific knowledge on the relationship between the environment and the economy. Finally, even in the most apparently simple market place, there are numerous challenges and limits in assessing the economic impact of a human activity.

The main issues, approaches and methodologies emerging from this first phase of the project are outlined next.

2.1.1 Property rights and non-homogeneous goods: private goods, public goods

Value or prices are strictly related to the property rights they command and the different characteristics of goods with respect to excludability and rivalry.

Typically, a private good is defined as a benefit that is (i) excludable and (ii) rivalrous. These two characteristics imply that the owners of the property right can exclude or prevent others from using the good or consuming its benefits, and that consumption by one necessarily prevents consumption by another.

In a market economy, property rights give some level of authority over a good to an agent (i.e. to an individual, state, iwi, community). Property rights can be characterised by:

- duration
- excludability
- transferability, and
- quality of the title.

All these characters can vary and are rarely absolute (e.g. right of access to coastal space, foreshore and seabed is not absolute, and the State reserves exclusive rights over aerial or underground resources, independently of their location; ownership of a property title does not enable the exclusion of consumption, especially in terms of landscape aesthetics).

Some of these rights emanate from national jurisdictions; others are locally, internationally or globally determined. As for excludability and rivalry, they are not necessarily intrinsic and invariable characteristics of a good, but are influenced by rules and regulations as well as technical, social and cultural conditions. Technological development can alter the capacity of exchange of property rights (e.g. online auctions) and the capacity to enforce excludability (e.g. encryption).

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and rationally consulting their own self-interest, will ultimately deplete a shared limited resource, even when it is clear that it is not in anyone's long-term interest for this to happen.

2.1.2 Market failures and externalities

Another crucial issue that affects the determination of market prices are market failures, which disrupt the assumption of marginal efficiency of market transactions.[25]
Market failures are often associated with information asymmetries, non-competitive markets, principal–agent problems, externalities, or public goods. Their existence is one of the most powerful justifications for government intervention.[26]

In the context of the Hauraki Gulf valuation project, externalities are of particular significance because often environmental goods are public goods and/or have poorly defined property rights. A negative externality happens when individual or private marginal costs and benefits are different from social ones. A typical example of negative externality is when a cost is not accounted for in balance sheets, as is often the case with air pollution or a build up of sediment in estuaries; therefore the marginal social cost of production would be higher than the marginal social benefit leading to excess production and consumption of certain goods. Conversely, positive externalities happen when the marginal social benefit is higher than the marginal social cost, as the producer of a good cannot capture the entire benefit (e.g. education), and therefore positive externalities can lead to lower than optimal production of the good (a case for public education). Under many circumstances, which can be exacerbated by technological development, open access to public goods (like fish) can produce environmental depletion.[27]

Most common solutions to market failure are the creation of implicit or explicit property rights through regulation, either through prescriptive command and control approaches (e.g. limits on input/output/discharge quantities, specified processes or equipment, audits) or by more flexible market-based instruments (e.g. taxes, or transferable permits or quotas, as in the case of fisheries in New Zealand).

In the context of the Hauraki Gulf, it is possible to check the validity of some of the (often unrealistic) assumptions under which a solution to the problem of externalities could operate efficiently.[28] The Coase theorem affirms that if property rights are clearly defined and assigned, externalities, such as environmental damages, would be internalised and resolved by relying on the private owners being incentivised to conserve resources for the future.[29] However, in the real world, given the frequent lack of critical knowledge on ecosystems, it could be a major mistake to treat our knowledge as 'perfect information'. Furthermore, transaction costs are normally relevant and legal frameworks do not operate efficiently. Therefore, strengthening markets and creating and strengthening property rights – as in the case of the fishing quota system – could mitigate, but not eliminate, environmental problems, especially if scientific knowledge is far from certain.

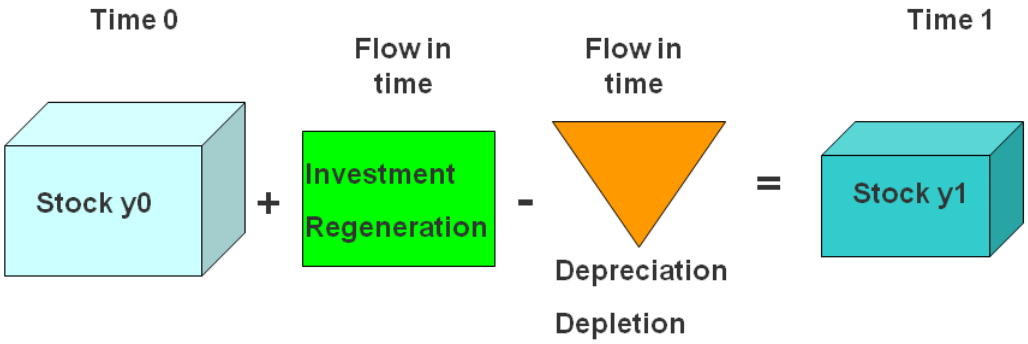
2.1.3 Market values and their different time frames

Monetary values have different time frames. While in many instances the practical use of economic valuation is assessing incremental change arising from a policy change, and not at valuing an entire ecosystem, in the

[25] The concept of Pareto efficiency.
[26] However, government policy interventions intended to correct market failures (i.e. taxes, subsidies, wage and price controls, planning and regulations) carry the risk of government failure, i.e. inefficient allocation of resources.
[27] This refers to the 'tragedy of the commons'.
[28] The assumptions are that (i) property rights can be defined univocally, (ii) people act rationally, and (iii) transaction costs (e.g. lawyers' bills) are negligible.
[29] Coase, Ronald H., 1960. 'The Problem of Social Cost.' *Journal of Law and Economics*, Vol. 3, October 1960.

context of this project, the valuation exercise focuses on the value of the benefits produced in and through the Hauraki Gulf that flow in a given period, not on marginal changes, nor on stocks.

Figure 6. Values and time



Notes:
1. Stocks are measured at one specific time (e.g. biomass, value of an infrastructure, or the total capital value of Auckland's real estate, which was officially worth $354 billion in October 2011).
2. Flows are measured over a time period (e.g. annual fish catch, annual value added, yearly depreciation, rent)
3. Potential are projections in the future (e.g. forecast, projected growth).

In the context of the first phase of the project, market value flows (e.g. value added, GDP) have been considered[30].

2.1.4 Non-market values

From a general and holistic perspective, the economy is just a subset of the environment and therefore the value of environmental benefits and services is at least as big as the value of the economy they support. However, since most environmental goods and services are not produced and exchanged through markets, they do not have a price, so often individuals and societies unwittingly assign them a zero value. The total economic value (TEV) framework is a way to address this lack of consideration and to translate some of those values in the market language of money.

Non-market values have no explicit monetary value or price and therefore are not captured into normal economic accounts. [31] In the context of the assessment of the Hauraki Gulf's TEV, non-market values mainly relate to ecosystem benefits, recreation, and cultural and spiritual values.

Many goods do not have a market value because, even though they do form part of markets, they are unaccounted and treated as externalities.[32] Examples of this would be climate regulation (an unaccounted benefit) and pollution (a commonly unaccounted cost).

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[30] The value of an asset can also be explained by the stream of net benefits it generates, e.g. rental property. When forecasts were available, the information has been included but not used to compare different activities.
Some sources also provide information on the value of stocks, which has been signalled.
[31] There are a number of techniques to assess non-market values, which will be discussed later.
[32] See section 2.1.2 for a discussion on market failures and externalities.

Because ecosystem services are not fully 'captured' in commercial markets, they are often given little or no weight in policy decisions[33]. This neglect may ultimately lead to environmental depletion and the undermining of the economy and human well-being.

In order to translate some of these values into prices, i.e. to assign them a dollar value, a number of techniques have been developed; for example, hedonic pricing and contingent valuation. Those techniques try to price the good or service by assessing individuals' maximum willingness to pay (WTP) for an improvement in environmental quality or their minimum willingness to accept (WTA) to forego an improvement in environmental quality. Marine reserves and recreational fishing are two examples in which the WTP technique has been used in this study, while hedonic price modelling was the methodology used for residential property.

Given that environmental services and benefits are the ultimate foundation of every market activity taking place in the Hauraki Gulf, we have not only provided a valuation of environmental benefits where available, but have also concentrated our efforts on highlighting the links or interdependency between environmental services and the economic activities we assessed. In so doing we have shown that ecosystems are not 'economic externalities', but often the fundamental source of necessary intermediate or final services or goods.

[33] For example, mangroves mitigate flood risk, hence damage against property, but also conflict with recreational use and navigational channels.

2.2 Economic Valuation Methods

Several existing valuations of specific activities taking place in the Hauraki Gulf have been identified by the project and Figure 7 provides an overview of the methodologies that those valuations have used to assess market and non-market values in the Hauraki Gulf.

Figure 7. Values and methodologies used by existing valuations

	Methodologies	Values /Activities
Market values	**Value added** **+** **Input Output Analysis** **Impacts** ▪ Direct ▪ Indirect ▪ Induced **Multipliers** **Gross value of catch** **Gross value**	**Tourism** **Recreational Marine Industry** **Events** **Aquaculture** **Port** **Cruise Industry** **Commercial Fishing** **Mining**
Non-market values	**Hedonic modelling (view and proximity to the sea)** **Willingness to Pay**	**Property values** **Recreational Fishing** **Marine Reserves -Goat Island**

2.2.1 Methodologies to assess market values

Market values are captured in the economic impact of industries that are reliant on the Hauraki Gulf for their operation. Commonly, an economic impact analysis calculates the value added of an economic activity (i.e. values of revenues minus values of intermediate goods and services). Value added can also be seen as the remuneration obtained by the production factors (work, capital, land) that generate an output. This approach is, in principle, a more accurate assessment of an economic activity than the total values of sales, or gross revenues. However, in order to calculate value added it is sometimes necessary to make assumptions about the technical structure of a certain sector which may not reflect the technology at the enterprise level as it is derived by a wider aggregation of economic activities (as in the case of an input-output model based on ANZSIC categories). Therefore, input-output analysis, although refining the gross revenues approach, does also introduce an additional level of error. In general, it is considered valid and provides a common ground for comparison.

This review found that the vast majority of the existing studies on the economic impact of human activities taking place in the Hauraki Gulf used a direct value-added measurement calculated through an input-output model and, in some cases, associated it with indirect and induced value added as well (see Figure 7).

In general, these assessments recognise that one form of economic expenditure in an industry is income for another industry. Therefore, new economic growth in one industry is not contained within the industry, but rather spreads and creates impacts through the economy. These studies identify three types of economic impact that can occur as a result of growth within a sector:

- *direct impacts*: initial injections of revenue and expenditure that accrue to that specific sector
- *indirect impacts*: net increase of economic activity generated by the provision of goods and services to the 'study sector', and
- *induced impacts*: net increase of economic activity due to increased household expenditure in the 'study sector'.

It should be noted that direct, indirect and induced impacts also occur in relation to employment.
Multiplier analysis (an extension of standard input-output analysis) was also used to capture the strength of the linkages between some 'study sectors' and the rest of the economy. The types of multipliers used are:

- **Type I multiplier**: this captures the direct and indirect backward linkage effects associated with direct expenditures. It is summarised by the equation: (Direct Effect + Indirect Effect)/Direct Effect. This type of multiplier captures the net effects of an investment in the 'study sector' sector on the production chain. (i.e. an increase of x in investment creates a impact of y in GDP).
- **Type II multiplier**: this is similar to a Type I multiplier but also includes induced effects. The equation is now: (Direct Effect + Indirect Effect + Induced Effect)/Direct Effect. Therefore, it also captures the effect of the increase in household wages and salaries paid to the workers in the 'study sector'.

2.2.2 Methodologies to assess non-market values

In order to assess non-market values a suit of methods has been developed over time. Broadly, they can be subdivided into two main categories:

- market-generated data, and
- non-market methods.

Market-generated data methodologies try to expand the realm of market values by introducing price-generating mechanisms such as:

- auctions, e.g. access to coastal space, and
- trading entitlements, e.g. quota rights, such as in the case of commercial fishery.

Non-market methods can be subdivided into[34]:

- *Revealed preferences*: methods based indirectly on the observed behaviour of humans
- Hedonic pricing is used to estimate economic values for ecosystem or environmental services that directly affect market prices. It is most commonly used to examine variations in housing prices that reflect the value of local environmental attributes. In this study hedonic pricing has been used to assess the impact of view and proximity to the sea on residential property values.
- Travel cost uses data about visitation to a site or set of sites to construct a demand curve for an environmental resource, e.g. a park. This method is primarily used to ascertain the recreational-use value of a resource based on its specific characteristics. The value of the Goat Island Marine Reserve has been calculated using this method.
- Replacement-cost methods value an environmental benefit by determining the cost of alternative built infrastructure required, or products that need to be purchased, to replace the service provided by the ecosystem in its current state; for example, nutrient filtering by wetlands, or shoreline protection.
- Avoided-damages methods assess the costs that are avoided because a given ecosystem good or service is present; for example, protection against hurricanes and floods.

b) *Stated Preferences*: methods based on the hypothetical behaviour of humans

- Contingent valuations (CVs) are commonly applied metrics for valuing environmental services and are either individuals' maximum willingness to pay (WTP) for an improvement in environmental quality or their minimum willingness to accept (WTA) to forego an improvement in environmental quality. As the aim is to discover people's rate of substitution between environmental quality and money, various techniques have been developed, including (i) questionnaire surveys that include bidding games, (ii) analysis of the correlation between declared value and personal characteristics of the sample, such as income, education, etc. (iii) 'take it or leave it' experiments, (iv) trade-offs games, and (v)the Delphi technique. CVs are usually expensive and are more useful for informing a policy change and for cost-benefits analyses.
- Benefits-transfer methods involve applying results obtained in existing studies to different areas; for example, estimating the value of one beach using the value calculated for a different beach of a similar size and type in a different area. Some benefits-transfer methods may use an economic model developed in one location to estimate the value of a resource in another location; characteristics of the new location can then be inserted in the previously developed model, providing a potential advantage over simply transferring the value estimates between locations. However, it is difficult to accurately assess the many factors that affect the values of an ecosystem good or service and, furthermore, these factors may vary between sites. Therefore, benefit-transfer methods should be used with caution.

2.2.3 Double counting

A problematic aspect of this exercise is double counting of the economic impact of related activities, a problem amplified by the application of the wider assessment methodology based on direct, indirect and induced economic impacts, as described in section 2.2.

This problem is particularly evident with some recreational activities (e.g. boating, cruise industry, tourism, events, recreational fishing and marine industry) as often these activities overlap, depending on which one is under evaluation. For example, recreational fishing has indirect impacts on the marine industry and tourism.

As a preliminary solution, which will need to be more carefully explored in the future, to avoid duplication and to partially overcome the lack of information, we have decided to adopt restrictive assumptions on the assessment of certain activities or even, as in the case of events, not to count their effects, instead assuming they are already captured by other parts of the report.

Although double counting can be seen as an obvious limitation of this study, it also does allow us to shed some light on economic inter-linkages while preserving the main focus of the study, which is to highlight the

[34] Barbera M. (2010)

intricate and intertwined relationship between the ecosystem services provided by the environment, the economy and all the values that are related to them.

3. The Environment and the Economy in the Hauraki Gulf

The Hauraki Gulf has a vast array of coastal marine and terrestrial (land-based) ecosystems which provide a wide range of benefits to its residents and visitors alike. In many cases, they represent necessary inputs to numerous economic activities that contribute a large share of Auckland's and Waikato's GDP, support cultural values and social opportunities, and provide a number of important 'services' that support human life and health.

The environment and its services visibly enhance the quality of our daily life and improve the value of our homes, while other services exist that we don't rely on every day but that become vital in times of trouble, e.g. during big storms or increased human pressures.

Many of these services are difficult to appreciate; people may not necessarily know about or understand them or may simply just take them for granted until they are compromised or lost.

3.1 Ecosystem goods and services

3.1.1 Definitions

Ecosystem goods and services defined as "the direct and indirect benefits that mankind receives or values from natural or semi-natural habitats" (Daly 1997, Constanza et al. 1997, Boyd and Banzhaf 2007).They show the link between 'natural' systems and processes and human well-being. Ecosystem goods and services are defined as 'the direct and indirect benefits that mankind receives or values from natural or semi-natural habitats'.[35] It is important to remember that benefits are not just economic, but include a contribution to well-being and quality of life.[36]

Ecosystem 'goods' are the **tangible resources** that can be extracted and utilised by humans, such as food and raw materials; resources must be renewable in a human time frame to be considered as a good in this definition.

Ecosystem 'services' are the abilities of ecological systems to **provide favourable conditions** for humans by processing material or providing intrinsic benefits (e.g. water filtration, dampening environmental pressures).

In 2000, the Millennium Ecosystem Assessment (MA) project was established. The project set out to assess ecosystem changes and the consequences to mankind so as to guide strategies for the sustainable use and conservation of these systems and their corresponding benefits. This United Nations project involved the efforts of more than 1300 experts, resulting in one of the most widely used frameworks for defining ecosystem goods and services.[37] The framework provides a consistent typology to communicate these goods and services across a variety of ecosystems types.

[35] Daily, 1997; Constanza et al., 1997; Boyd and Banzhaf, 2007.
[36] Fisher et al., 2009.
[37] Fisher et al., 2009; Royal Society, 2011.

3.1.2 Classification of ecosystem goods and services

The Millennium Ecosystem Assessment categorises goods and services into four broad categories:

- *Provisioning services*: the tangible products obtained from ecosystems (e.g. wood, fibre, fresh water, food production).
- *Regulating services*: the benefits humans receive from the maintenance of ecosystem processes (e.g. air quality, water regulation and purification).
- *Supporting services*: these services are necessary for the production of all other services. They are not directly used by humans but are critical to the maintenance of other services. They may occur over long time periods (e.g. soil-formation services which indirectly impact food production).
- *Cultural services*: the non-material benefits that humans obtain from the environment (e.g. spiritual enrichment, and recreation and aesthetic experiences).[38]

While providing a widely accepted typology, the MA did not have a strong focus on marine ecosystems. A recent technical report[39] and publication[40] provide an introduction to and a summary of the types of goods and services provided by the marine ecosystems of the Hauraki Gulf. In general, the terrestrial ecosystems found on the islands and surrounding coastline of the Hauraki Gulf provide the same types of goods and services; however, there are a few additions specifically provided by land-based ecosystems. Table 1 provides a list of the goods and services that are provided by marine and terrestrial ecosystems in the Hauraki Gulf.[41]

Table 5. Ecosystem goods and services that are obtained from coastal marine and terrestrial environments in the Hauraki Gulf

Supporting	Regulating	Provisioning	Cultural
Services necessary for production of other ecosystem services	Benefits obtained from regulation of ecosystem processes	Goods produced or provided by ecosystems	Non-material benefits from ecosystems
▪ resilience and resistance ▪ habitat structure ▪ soil formation ▪ pollination	• disturbance prevention • waste treatment, processing and storage • water regulation (including flood regulations) • sediment retention • biological control (including disease regulation) • *gas and climate regulation • *nutrient regulation	▪ food provision ▪ raw materials ▪ genetic and medicinal resources ▪ water supply	▪ spiritual and cultural ▪ recreational ▪ aesthetic ▪ inspirational ▪ educational and cognitive benefits ▪ non-use benefits ▪ speculative benefits

Note: *Gas and climate regulation and nutrient regulation can also be classified as supporting services.

Source: Townsend and Thrush, 2010; Costanza et al., 1997.

An explanation of the goods and services listed in Table 5 is provided in the following text.[42] Brief examples of marine and terrestrial species or resources involved with the service delivery in the Hauraki Gulf and New

[38] MA, 2003.
[39] TR2010/033.
[40] Townsend et al., 2011.
[41] Townsend and Thrush, 2010; Constanza et al., 1997.
[42] Adapted from Townsend and Thrush, 2010; Costanza et al., 1997.

Zealand are included. More detailed examples can be found in Townsend and Thrush (2010) and other references given.

Supporting Services

Maintaining biodiversity

Biodiversity has many definitions but generally it is the variability among living organisms including within and between species (e.g. species richness) and within and between ecosystems (e.g. ecosystem complexity). Biodiversity is the source of many ecosystem goods and is fundamental to many ecosystem services, while changes in biodiversity can influence the availability of goods and delivery of services.[43] A vitally important component of biodiversity is the maintenance of resilient and resistant ecosystems. Ecosystems and their communities may be able to absorb natural and human pressures. When disturbed, the speed at which they can recover and return to the pre-disturbed state is important for continuance of service delivery. Thus, ecosystem resilience and resistance are vital in underpinning the maintenance of all other services. Resilience and resistance may be one of the most important ecosystem services in terms of sustaining life and lifestyles as we know it.

The maintenance of food webs and trophic dynamics[44] is also an important component of biodiversity. Key predators are able to control the abundances of prey and lower trophic levels through their trophic-dynamic relationships with species. This biological pressure may also reduce the invasion success of non-native species (e.g. biological control).

Some key predators in the Hauraki Gulf include many species of birds and fishes. For example, snapper are an important predator of urchins which graze on kelp plants. If snapper are removed through fishing pressure then they no longer exert control on urchin populations, which allows the urchin population to increase to a point where they impact on kelp populations resulting in what is termed urchin barrens – areas with urchins and no kelp.[45] Kelp is an important contributor to productivity in the near-shore area and a habitat for many species. Predatory invertebrates include some crabs, worms and molluscs. Other species are able to exert control through non-predatory actions, such as influencing community composition through bioturbation and filtering activity.[46] On land, birds, amphibians, reptiles, freshwater fish and invertebrates are important upper-trophic-level predators which contribute to the maintenance of food webs. In general there are few studies on their dynamics and effects on native ecosystems, with the majority of research work focused on their effect on economically important horticultural crops.[47]

Pest-eradication efforts on some Hauraki Gulf islands mean that the Gulf is now a significantly important area for supporting the conservation of a number of threatened and iconic species, such as tuatara, geckos, skinks, giant weta and the very rare brown teal. There are also a number of other uncommon animals which are being conserved on various islands and are available for visitors to experience, adding to the islands' value. A major ecotourist area is Tiritiri Matangi Island, where one can see kokako, takahe, stitchbird and saddleback. There are also a large number of threatened seabirds breeding on Hauraki Gulf islands, such as the endangered black (Parkinson's) petrel, a key top predator, which breeds only on Great Barrier and Little Barrier islands. Seabirds are well known for their role as ecosystem engineers due to the marine nutrients they bring to their terrestrial breeding grounds, thus helping to stabilise these ecosystems.

Habitat formation

Marine and terrestrial habitats provide living space for species and so are a prerequisite for the provision of all other goods and services. By producing shells, root structures and through other activities, marine

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[43] MA, 2003.
[44] the interaction between species at different levels on the food web
[45] Shears et al., 2002.
[46] see Townsend and Thrush, 2002.
[47] Brokerhoff et al., 2010.

animals and plants change the marine environment and provide space and shelter for other organisms to live in. This role is comparable with trees in a forest, which are important for other plants, birds, insects and many other different kinds of species.

Coral reefs are the most iconic example of marine-habitat formers, but many other organisms modify the topography of the sea floor in the Hauraki Gulf. Examples of these modifications include reefs created by oysters, horse mussels (*Atrina*) and mussels, shell hash from abundant bivalves, root structures from mangroves, seagrass meadows and tubeworm mats. Less obvious, but just as important, are the habitat modifiers that work below the sediment surface, such as burrowing crabs, bioturbating worms and urchins.

Soil formation

Soil is formed in the terrestrial environment by the erosion of rock and the accumulation of organic material (e.g. detritus). Soils are considered natural capital,[48] supporting vegetation on land as a substrate, a nutrient and water source, and also supporting life underground ('soil life') which includes micro-organisms, fungi and other plants and animals. Soil is linked to many of the other ecosystem services such as nutrient and water cycling, provisioning of food and raw materials, regulating carbon, and recycling of wastes. The quality of soil tends to be assessed by a number of soil components that measure the physical (e.g. stone content), chemical (e.g. pH), and biological (e.g. microbial biomass) characteristics of the soil. Although no detailed records of soil quality exist for the Hauraki Gulf, a general soil register exists within the Auckland Council for the Auckland region.

Water supply

Water supply refers to the retention, filtering and storage of water in lakes, streams and underground reservoirs and aquifers. The supply of water is important for agriculture, industry and household consumption. The Auckland region has limited supplies of fresh water, which relates to its geography and geology; however, the aquifers that exist are considered an important water source for both rural and industrial uses within the urban areas.[49]

Pollination

Pollination refers to the movement of flora and fungal gametes by terrestrial animals, namely invertebrates and birds. It is inherently important in plant reproduction and dispersal. A recent study by Anderson et al. (2011) conducted in the North Island of New Zealand, including on Little Barrier and Tiritiri Matangi islands in the Hauraki Gulf, highlighted the importance of native birds as pollinators and seed dispersers. On the mainland, a lack of the native pollinators, namely bellbirds and stitchbirds, has led to an 84% reduction in seed output of the native shrub *Rhabdothamnus solandri*.

Regulating Services

Storm protection

This refers to the mitigation of environmental disturbance by biogenic structures or biogenically modified habitats.

Coastal plants like mangroves and seagrass and animals that create biological structures can reduce the impact of storms, waves and tides. These work as natural sea defences and help to protect our shores, properties and coastal structures from erosion and storm damage. Terrestrial plants similarly act to dampen environmental fluctuations, providing storm protection.

Cleaning water and air and absorbing and detoxifying pollutants

This refers to the removal of waste material, organic (e.g. sewage) or inorganic (e.g. heavy metals), through a combination of recycling, burial and storage. Marine animals and plants that live in the mud and sand move

[48] Dominati et al., 2010.
[49] Crowcoft & Smaill, 2001.

sediment around and so play important roles in the cycling of nutrients and waste. Some waste can be broken down and removed, and some can be locked away and stored deeper in the sediment.

Many of the species dwelling in coastal and estuarine soft sediments around the Auckland region play important roles in the cycling of sediments and consequently organic and inorganic contaminants.[50] Ponds, lakes and wetlands are well known for their use for treatment of wastewaters from urban and rural areas,[51] and hence are of important value to the Hauraki Gulf, particularly on the mainland areas.

Water regulation (flood and drought protection)

This refers to the role of the land and vegetation in regulating run-off into rivers and estuaries and the subsequent fluvial discharge and in providing flood control and drought recovery; hence this may be considered primarily a terrestrial service. There are many different coastal plants that help regulate the speed that water runs off the land into estuaries and the sea. This is important to the environment and can also help prevent flooding – but plants do need to be of sufficient number and size. Plants and also some animals (which live in mud and sand) can prevent beach material from being washed away, by binding the sediment.

In the Hauraki Gulf and, in particular, in urban areas along the Gulf, the capacity for the land and flora to regulate water discharge may be limited due to the high percentage of land that has been modified and concreted, with the discharge of material regulated through stormwater management practices. Impervious areas accounted for 42% of land within the Auckland Metropolitan Urban Limits in 2008.[52] However, there are substantial vegetated areas of mangroves in the upper estuaries that perform this function. Although lakes are also important for water regulation, they are likely to be less significant than vegetated areas as there are few lakes within the Hauraki Gulf catchment.

Sediment retention and generation

This refers to the role of vegetation, lakes, wetlands and sediment biota in the process of sediment retention and sediment generation. Plant species such as mangroves and seagrass, when in sufficient densities, prevent the erosion of intertidal sediments and increase the levels of deposition. Animals such as worms that form tube-mats can be important in stabilising sediments. Likewise on land, terrestrial plants help to anchor sediment, keeping it intact where it may remain as a valuable resource for other ecosystem services (e.g. soil formation) and out of marine environments where terrestrial sediments may have detrimental effects on the ecosystem.

Species can also play a role in sediment generation. For example, at Pakiri Beach there are approximately 25 kilometres of beach and sandy sediments which run offshore for about 4 kilometres to a depth of about 40 metres. In this area, like many around New Zealand, carbonate derived from the shells of bivalve molluscs makes up 40–70% of the sediment by weight.[53]

Gas and climate regulation

This describes the balance of chemical exchange between marine and terrestrial ecosystems and the atmosphere, which is influenced by the activities of organisms. The coastal, marine and terrestrial environment is important for balancing the air we breathe and regulating the climate. Gases like carbon dioxide (CO_2) dissolve into seawater and can be locked away in the shells of shellfish and other animals. Land plants also sequester CO_2 in a similar manner, storing the compound in its biomass both above and below the ground. Unhealthy sediments can release methane, which is a harmful greenhouse gas.

Carbon storage in soils and biomass has been the subject of many studies, particularly with the aim to ascertain its importance in global climate change. Several of the islands in the Hauraki Gulf contain large patches of indigenous forest (e.g. Rangitoto, Little Barrier and Great Barrier islands) which are known to be important carbon sinks. For example, terrestrial ecosystems throughout New Zealand have been estimated

[50] See Townsend and Thrush, 2010.
[51] Tanner & Sukias, 2003.
[52] ARC, 2009.
[53] Hilton, 1990.

to harbour 2420 million tonnes of carbon, with 80% of this amount occurring in indigenous forested ecosystems. [54]

Nutrient storage and cycling
This refers to the cycling of organic and inorganic nutrients by the activities of marine and terrestrial species. The seabed and the animals that live in it are important for the cycling of nutrients. The activity of these animals keeps the coastal system healthy and makes nutrients available, which underpins food production.

Provisioning Services

Food provision
This is defined as the extraction of organisms for human consumption. In New Zealand, coastal food provision is a fundamental and highly valued service. Many different species of fish are targeted; however, snapper is the most iconic fish species for the North Island. Other important species include tarakihi and kingfish which are of high recreational and customary value. In the local coastal environment other important species for food provision include intertidal shellfish such as cockles, pipis and oysters, as well as some gastropods. Subtidally, mussels, scallops, kina, paua, paddle crabs and crayfish are commercially and culturally prized. Although not a large resource in comparison to the marine environment, the land areas of the Hauraki Gulf provide some food from crops (e.g. vineyards on Waiheke Island) as well as livestock from limited grazing areas on some of the islands.

Renewable raw material
This service is defined as use or extraction of renewable materials for all purposes except that of human consumption. (Excluded from this definition is the extraction of hydrocarbons, minerals and sand mining for construction as these are not considered to be renewable within a time scale relevant to humans).

In the Hauraki Gulf, shell hash for the aquaria trade and landscaping is probably the main raw material extracted, although the quantities are still only a minor. Harvest of seaweed could also be a potential extraction in the future. The definition also could include the generation of renewable energy such as tidal- and wave-generated electric power, which is likely to be increasingly important for New Zealand – although such power generation is likely to be more important for Auckland's west coast than the Hauraki Gulf on the east coast of Auckland. A similar trend exists for land-based raw materials in the Hauraki Gulf, with fewer raw materials on the east coast in comparison to the west. However, there are some timber reserves in the forestry areas at Mangawhai as well as various smaller, private blocks on Great Barrier Island and Waiheke, and flax and driftwood may also be obtained from the terrestrial areas of the Hauraki Gulf.

Genetic and medicinal resources
Plants and animals may contain genetic information and biogenic-chemicals that have uses in the medical and pharmaceuticals industries. In New Zealand, examples include developments in anti-cancer research using species of sponge. No examples from the Hauraki Gulf are currently known, but the potential may be there and is important for preserving future options.

Cultural Services
Cultural services largely rely on the integrity of the entire system. All services can be linked to cultural service provision in some capacity; for example, the experience of leisure and recreation has links to productivity (e.g. the act of fishing) and water clarity (e.g. swimming, aesthetic value), which are in turn influenced by material processing and habitat provision.

Leisure and recreation
This refers to the use of or engagement with marine resources for stimulation or relaxation of the human body and mind. Leisure and recreation relate to our quality of experience which is related to the perception of a healthy environment which, in turn, is maintained by regulating services. The importance of those

[54] Tate et al., 1997.

regulating services will vary between contact and non-contact recreational activities, with human health risk being a key driver in contact recreation.

This is one of the more obvious services that the coastal system provides with many examples in the Hauraki Gulf; this service also has strong links to the tourism industry. Sailing and boating, for example, are a key activity in the Auckland area. Other leisure pursuits include nature watching, diving and fishing. Inshore and shallow-water pursuits include numerous beach activities such as swimming, sunbathing and walking on the beach, with the latter popular all year round.

Cultural and spiritual heritage
This refers to the benefits provided by marine resources that are of significance to the cultural and/or spiritual identities of the community. The value of marine resources has a strong presence in Maori spirituality. Human communities living by the sea have attached importance to marine ecosystems that are integral to the cultural definition of that community. The collection of food from marine resources (fishing and gathering) in addition to providing food is of strong cultural importance to many New Zealanders, inclusive of Maori.

Cognitive benefits
This refers to the value of natural resources to cognitive development, which includes education and scientific research. Many species provide stimulation for cognitive development, and much of the marine research effort in New Zealand occurs within the Hauraki Gulf. Information contained within natural systems can be adapted or exploited by humans for societal development.

Non-use benefits
This refers to the values that humans place on aspects of ecological systems or on certain species, despite the fact that they are unlikely to directly interact with them. Non-use values cover existence and bequest. 'Existence value' is the contentment derived in the knowledge that an ecosystem contains a natural resource or species (e.g. dolphins, seabirds, landscapes and/or geological features) even if the landscape is never personally experienced. This can be motivated by selfish reasons or by altruism. 'Bequest' value is the importance placed on the availability of a natural resource or the survival of a species for future human generations.

Speculative benefits
These are also known as 'option use values' and describe the importance that humans place in ecosystems having attributes that may become valuable in the future; for example, for future medical research.[55]

3.2 The Complexity of Ecosystems and of their Links to Human Welfare

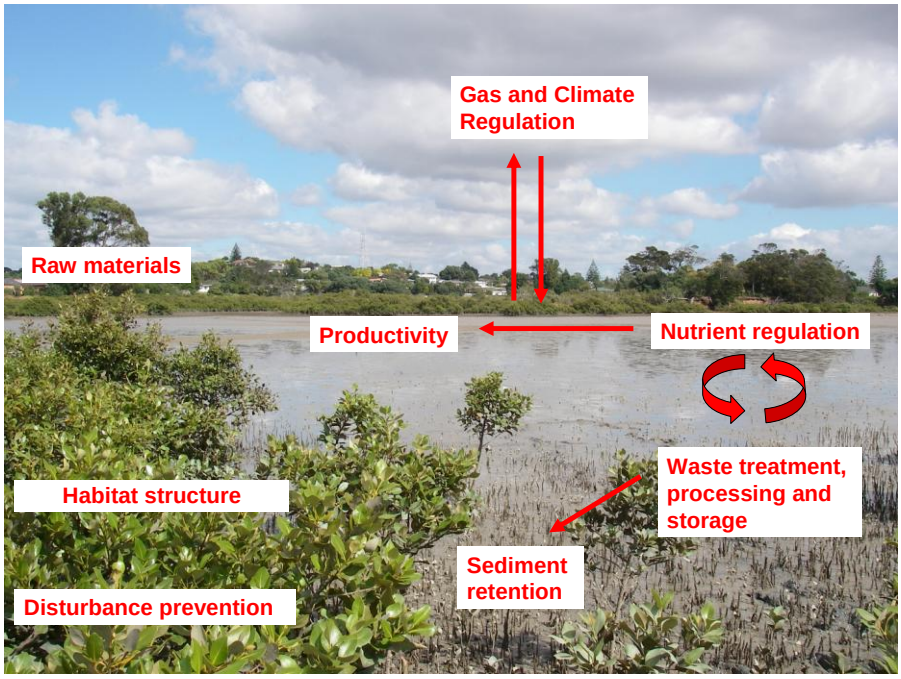
[55] Hanley et al., 2001.

The Hauraki Gulf, although bound within its given geography, is not one homogeneous marine system but rather a collection of heterogeneous and complex ecosystems which interact among themselves.

For example, the Hauraki Gulf is endowed with a huge diversity of coastal habitats and systems, such as:

- sea grass beds to seaweed, soft sediment to reefs
- sheltered tidal creeks to sheltered coasts and exposed open coasts, and
- numerous small estuaries to large harbours.

Figure 8. Examples of multiple ecosystem services that a single site can provide



Source: Townsend, 2010; photo: NIWA.

The economic valuation of ecosystem functions and services and the benefit they generate for human is an emergent research area in the past decade, based on recognition of complex systems, co-dependencies and adaptive feedbacks between variables in the economic and natural systems.

Ecological systems are fundamentally complex and present many challenges when trying to include them in valuation frameworks or decision making. There are many difficulties related to the interpretation and valuation of ecosystem services, some of which are outlined next.

3.2.1 Spatial and temporal dynamism

Spatial and temporal dynamism is inherent in the production of goods and services. Ecosystems and the services they provide are heterogeneous in space and evolve in time. As shown Figure 8, in a relative small site, ecosystems provide many services and benefits, some of which are used in situ (such as raw materials), others are provided at one location at one time but benefits are realised in another location at another time (such as gas and climate regulation). Marine environments are inherently complex due to their connectivity, and consequently benefits often occur in different places to where they are underpinned.

These dynamisms have direct economic implications, particularly given peoples choices and preferences. For example, Aucklanders show a greater willingness to pay for improvements in quality at outer coastal

beaches compared to middle- and upper-harbour locations.[56] However, because many of the outer coastal beach services are generated elsewhere, such as sediment retention and waste processing which affect the quality of the outer coastal beaches, upper harbour sites need to be improved to achieve these benefits. Conversely, a location could be negatively affected by a damage originating elsewhere and in a different time (e.g. agricultural sediments, storm water).

3.2.2 Joint production

The relationship between services and benefits or values is not a direct linear relationship. Just as ecosystems can provide a number of ecosystem services, these ecosystem services can deliver multiple benefits for human welfare[57]. These are considered 'joint products'.[58] As shown by Figure 9 (Long Bay in Auckland), the interactions among several ecosystem services results in clean water and therefore human benefits such as leisure and recreation. These ecosystem services therefore provide joint products, or multiple benefits. Joint production is a characteristic of ecosystem services that affects the determination of the 'environmental inputs' provided by specific ecosystems as they are often intrinsically interlinked. The benefits themselves are connected through feedback loops, where human activity affects the ecosystem structure and function and therefore the production of goods and provision of services.

Figure 9. Joint production of benefits in Long Bay, Auckland

Source: Townsend, 2010.

[56] Batstone and Sinner, 2010.
[57] For example the benefit of fishing is dependent on both the provision of stock to fish, and also on the regulating and supporting services to provide the healthy environment from which to harvest this fish. This joint production becomes more important for cultural services such as leisure and recreation where it is the quality of experience that is most important.
[58] See Daily, 1997b, for chapters regarding multiple services produced by individual systems and biomes.

3.3.3 Benefit dependence

Ecosystem services are often considered by people only to the extent they provide them an understood and perceived benefit, i.e. they are benefit dependent.[59] For example, if you are interested in fishing, then snapper are a final benefit in their own right; however, if you are only interested in availability of kelp forests, then snapper are merely providing an intermediate ecosystem service by controlling sea urchins which eat the kelp. Whether the service is considered to be final or intermediate will change depending on what is being valued, monitored or measured, as well as who the beneficiaries are.[60]

Different stakeholders (or even different individuals) often perceive different benefits from the same ecosystem processes, so they can at times be conflicting[61]. This is the case, for example, of fishing and marine reserves: in economic terms, these services are rivals.

Further complications stem from the fact that many intermediate and final ecosystem services are valuable, providing benefits to humans, even if the stakeholders themselves do not perceive the service. Climate regulation is an example of a vital service for human well-being that is probably not perceived by a large portion of the Earth's population.[62]

The characteristics all interact to make the classification of ecosystem services, their goods and their interaction with the economy particularly complex. For example, a good can be considered either a public or private good (or both), and the dynamics of its consumption (its congestibility) is also a function, for example, of social and regulatory systems and technological development. This complexity also relate to the numerous and interrelated policy instruments that could be used to regulate the interaction between the economy and the environment; for example, access fees, change in property rights, taxes, subsidies, tradable permits, national or multinational regulation, or devices to change individual or group incentives.

3.3 Linking the Environment and the Economy: the Approach Adopted

In previous sections we have:

- specified the ecosystem services of the Hauraki Gulf, and
- described the benefits realised by human beings.

As the goal of the objective of this Phase 1 report is to identify the environmental and economic benefits provided by the HGMP, it is therefore useful at this point to link those environmental services described to economic benefits identified for the Hauraki Gulf.

A **benefit**[63] is realised at the point where human welfare is directly affected and where usually other forms of capital (built, human and social) are needed to realise the gain in welfare. For example, clean water provision is a service for fishing, and clean water for swimming is a benefit (requiring travel costs, etc.).[64]

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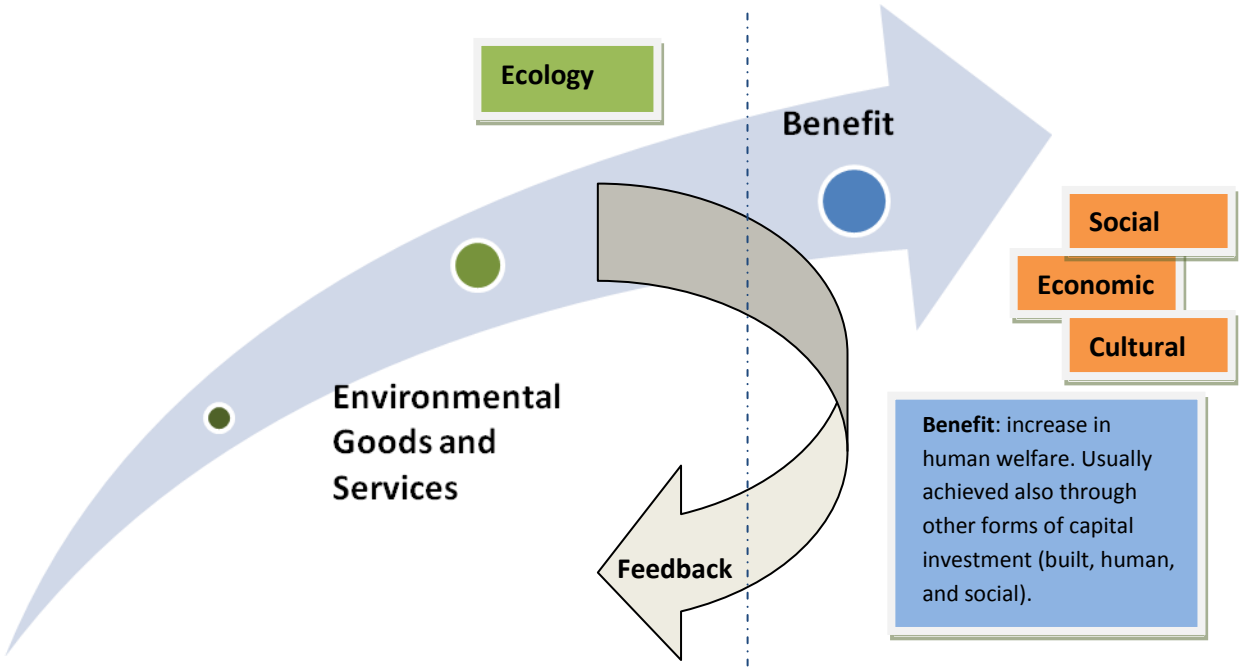
[59] Boyd and Banzhaf, 2007.
[60] See Boyd, 2007, for a full treatment of benefit dependence.
[61] Turner et al., 2003; Hein et al., 2006.
[62] Economic valuation is typically focused on marginal changes. However, what constitutes a marginal change in regards to ecosystem processes and services is not always clear and price changes will likely not reflect the 'ecological quantities' important for the delivery of that service (Gowdy and Erikson, 2005). A number of problems in the valuation process have been identified; for example, the value people place on environmental goods and services through stated preferences techniques, are susceptible to a number of inconsistencies as well as the incommensurability of different environmental services.
[63] **Benefit** is intended as a positive contribution to human well-being.
[64] One of the reasons why it is useful to adopt this classification is to avoid potential double counting, as only benefits should be valued.

Furthermore, different activities have different environmental impacts (**feedback**[65]) on the environment; some activities are relatively neutral, while others have high negative impacts, ongoing or potential (e.g. a major shipping disaster in the Hauraki Gulf).

Figure 10 schematises a pathway that links the ecosystem goods and services with the economy in the Hauraki Gulf.

Figure 10. Ecosystem pathways and economic benefits



Due to these complexities and our incomplete knowledge, there is no clear consensus on economic valuation frameworks or indeed on the merit of monetising goods and services. Ecological systems are fundamentally complex and even complete system understanding may preclude accurate accounting of their value, so at this stage the most useful approach is perhaps the process of developing an understanding within the community of the role of the ecosystem and their values (Royal Society 2011, Fisher et al. 2009). A pathway to this is the simplification of these systems and making clear linkages with the benefits derived. In Phase One of this Hauraki Gulf TEV, the objective is to gather available information on the benefits associated with the Gulf. In this section we have identified ecosystem services provided by the Hauraki Gulf and described the benefits derived by humans. Table 6 and Table 7 are therefore just a tentative schematisation of some of these pathways, that is the complex relationships between environmental goods and services and the economic activities analysed later in this report.

As a first consideration, the main difference between the two groups of activities included in the two tables, is that the first ones (Table 6) are mainly related to renewable ecosystem goods and services, (as classified and described previous paragraphs), while port and mining depend, respectively, on the physical infrastructure and non renewable resources provided by the environment. This could imply that the latter group (Table 7) do not see the ecological quality as a critical factor of their business model, or "value proposition"[66] as it is often referred to in the business community. Conversely, the activities grouped in table 2 share a common interest in protecting the environment, obviously with different emphasis and

[65] **Feedback** is intended as the response/impact of a particular activity/process on the environment.
[66] A value proposition can be defined as a promise of value to be delivered by a firm and the corresponding belief from the customer that value will be experienced.

perspectives, as they consider the flow of ecological goods and services as a crucial input of their economic activity and at the very core of their value proposition.

Table 6. Ecosystem goods & services and activities in the Hauraki Gulf : fishing, aquaculture, recreational activities, property and public amenities

Environmental Goods and Services[67]	Benefits	
• **Supporting goods & services** • **Regulating goods & services** • **Provisioning goods & services** • **Cultural goods & services**	**commercial fishing**	**extractive**[68]
	aquaculture	**non-extractive but invasive**[69] **and exclusive**
	recreational fishing	**partially non-extractive**[70]
	• **recreational (non-extractive) (*)** • **social** • **cultural** • **property values** • **public amenities**	**non-extractive**

Notes: (*) Includes tourism, events, marine reserves, boating, recreational marine industry, cruise industry

[67] See Table 2.
[68] **Extractive** refers to the fact that an activity extracts from the environment a natural resource (e.g. fish, sand).
[69] **Invasive and exclusive** in this context is intended as a characteristic of an activity to occupy the marine space (that it is confined to) in an exclusive and permanent way, that is not allowing its use by other activities (e.g. marinas, aquaculture farms).
[70] **Partially non extractive** as recreational fishers value not only the catch, but also by the "experience", and increasingly –as signalled by the Ministry of Primary Industries, they practice catch and release.

Table 7. Ecosystem goods & services and activities in the Hauraki Gulf: Port, Transport, Navy and Mining

Environmental Goods and Services[71]		Benefits	
• **Physical structure**	**Shoreline and storm protection**	**port transport navy**	**partially extractive (dredging)[72] invasive and exclusive**
• **Exhaustible resources**	**Minerals and sand**	**mining**	**extractive, invasive and exclusive**

The schematisation provided by table 2 and 3 aims at highlighting how the economy and the environment are intimately intertwined. They display how many different sets of ecological goods and services contribute to the realisation of the human benefits associated with those activities, which in turn have different feedbacks on the environment.

The description of these ecological goods and services has been provided earlier in this section, Tables 2 and 3 display a visual link between the environment and the economic activities assessed in the following sections. For example, they show that fishing's reliance on fish availability relates not just to the provision of biomass, but is supported by a complex and intertwined set of other ecological goods and services that are often treated as a hidden input which is not factored in the economic valuation. This implies that often those "hidden" goods and services are disregarded in the market space (in economic terms they are externalities) and could be overexploited leading to environmental degradation and widespread environmental and economic damage.

Further, economic activities differ also in terms of their feedback on the environment. Again, table 2 and 3 provide some hints in this direction. For example, some are extractive activities, as for fishing, but less so for recreational fishing as it also realises benefits from recreational aspects not strictly related to the catch; other activities are non extractives but invasive and exclusive as they occupy a certain area and prevent other activities/benefits from being realised there, as for example in the case of aquaculture, marinas and port.

This complex web of relationships, which needs to be further explored in the future, underline the economy's dependence on the environment and underpins the economic assessment presented in the next sections.

[71] See Table 2.
[72] Dredging is classified as **partially extractive** as it is not a continuous activity.

4. Preliminary Results and the Emergence of an Eco-Cluster

4.1 Known and Unknowns

This section presents the summary of the preliminary results obtained through the partial assessment of some economic values of the Hauraki Gulf, both in Auckland and the Coromandel. The detailed valuation of all the benefits and activities identified will be individually presented in the following sections. As it has been raised previously throughout the study, these results have to be interpreted and used with caution.

The main aim of this section is no to be a final point, but to set the stage for the discussion on "where to from here".

The goal of the project's first phase was to identify the most important economic benefits provided by the Hauraki Gulf, to establish if their economic valuation had already been undertaken with a suitable methodology, to present preliminary results, and to identify gaps.

As a result, we have attempted to define economic benefits and discriminate between known and unknowns (see Table 8).

Table 8 represents a starting point for the re-scoping of the project and initiates its second phase.

Table 8. List of known and unknown benefits provided by the Hauraki Gulf

Knowns	**Partially unknown** As already captured by some of the recreational knowns	**Unknowns/ Gaps**
• Port • Cruise Industry • Recreational Marine Industry • Aquaculture • Fishing : ▪ commercial ▪ recreational ▪ customary (partially) • Tourism • Events	• Boating and other recreational activities[73] • Marinas • Transport/Ferries[74] • Property values[75] • Marine Reserves (partially) • Mining	• Navy[76] • Environmental goods and services not yet accounted for **Out of the Scope of Phase 1** • Option values • Existence values • Bequest Values • Cultural values • Social values • Spiritual values

[73] E.g. surfing.
[74] The economic impact on transport ferries in the Hauraki Gulf is already captured by the tourism and cruise ships values. However, commuting transport flows are not included and quantified. In 2011 there were approximately 2 million passengers who commute by ferry every year in Auckland (Auckland Transport) and there is increasing interest in expanding capacity.
[75] Impact of view and proximity to the sea has been estimated.
[76] A study on the economic impact of the Sydney naval bases has been carried out by KPMG, using an economic impact assessment methodology: KPMG, 2011. *Economic Contribution of the Naval Bases in Sydney*. Another similar example is the Canadian Navy's report *Economic Impact of the Navy on the Hampton Roads Area*, issued in 2008.

4.2 Gaps and Value Sets Not Considered

Table 8 highlights the main gaps identified. Some of those are partially known and could be explored through methodologies (GDP contribution) similar to those already adopted. They are: Boating, Marinas, Transport/Ferries, the Naval Base in Devonport, Marine Reserves, Mining and the impact of the Hauraki Gulf on property values (which is briefly described in Section 4.2.1).

Another area where more research is recommended is the one related to the links between the economy and ecological goods and services, which could also include agricultural sectors, such as dairying, horticulture and viticulture. Section 3 has shed some light and started the exploration and discussion of some relevant aspects, but more detailed understanding of the ecological dynamics of the Gulf and of their relation with the economy is needed.

Others, such as cultural, social, spiritual values were out of the scope of this first phase as its valuation perspective was strictly economical. This "reductionist" approach, as already stated, is a starting point only as we are aware of the numerous other values sets that maybe associated with the Hauraki Gulf. For example, the Gulf is a place of unique cultural and spiritual significance for Maori.

Another important value set which has not been analysed relates to social values. Although no calculation has been made yet, the social values of the Hauraki Gulf are likely to be of particular significance given the presence of Auckland, the country's largest city, on the shores of the Gulf. For example, having easy and free access to a healthy Hauraki Gulf environment provides high social, recreational and cultural values. Because of this availability, households are able to enjoy the benefits of high environmental quality and amenities allocating limited portions of their income to recreational and cultural activities.

Conversely, an increase of environmental degradation and the shrinking of public places (such as parks, beaches, reserves, etc.) would negatively and disproportionately affect those on low incomes, as higher-income people can afford to pay and travel more to enjoy these benefits elsewhere. In addition, the need to travel further distances to access a clean environment would also affect general public welfare and increase the demand for already scarce transport infrastructures.

Finally, some unknowns could be simply unknown to us.

4.2.1 Property values

One of the significant economic impacts of the Hauraki Gulf, identified but only partially assessed at this stage of the research, is the one that affects costal properties that enjoy proximity to the sea and/or a view. The value of the Hauraki Gulf is embedded in these coastal residential properties located in Auckland and the Coromandel. Hedonic pricing estimation results show the significant impact of water amenity on land price. This impact increases with the scope of views and decreases with the access distance to the beach. For example, keeping all other variables constant, the land of a property on the coastline of the North Shore of Auckland with wide water views could cost, on average, 59%, 48% and 32% more than the land of properties located 2000, 500 and 100 and metres away from the coast, respectively.[77] Given Auckland and Coromandel topographies, the value that properties derive from the Hauraki Gulf could probably account for several billions of dollars and could produce an income flow of several hundred million dollars annually.[78]

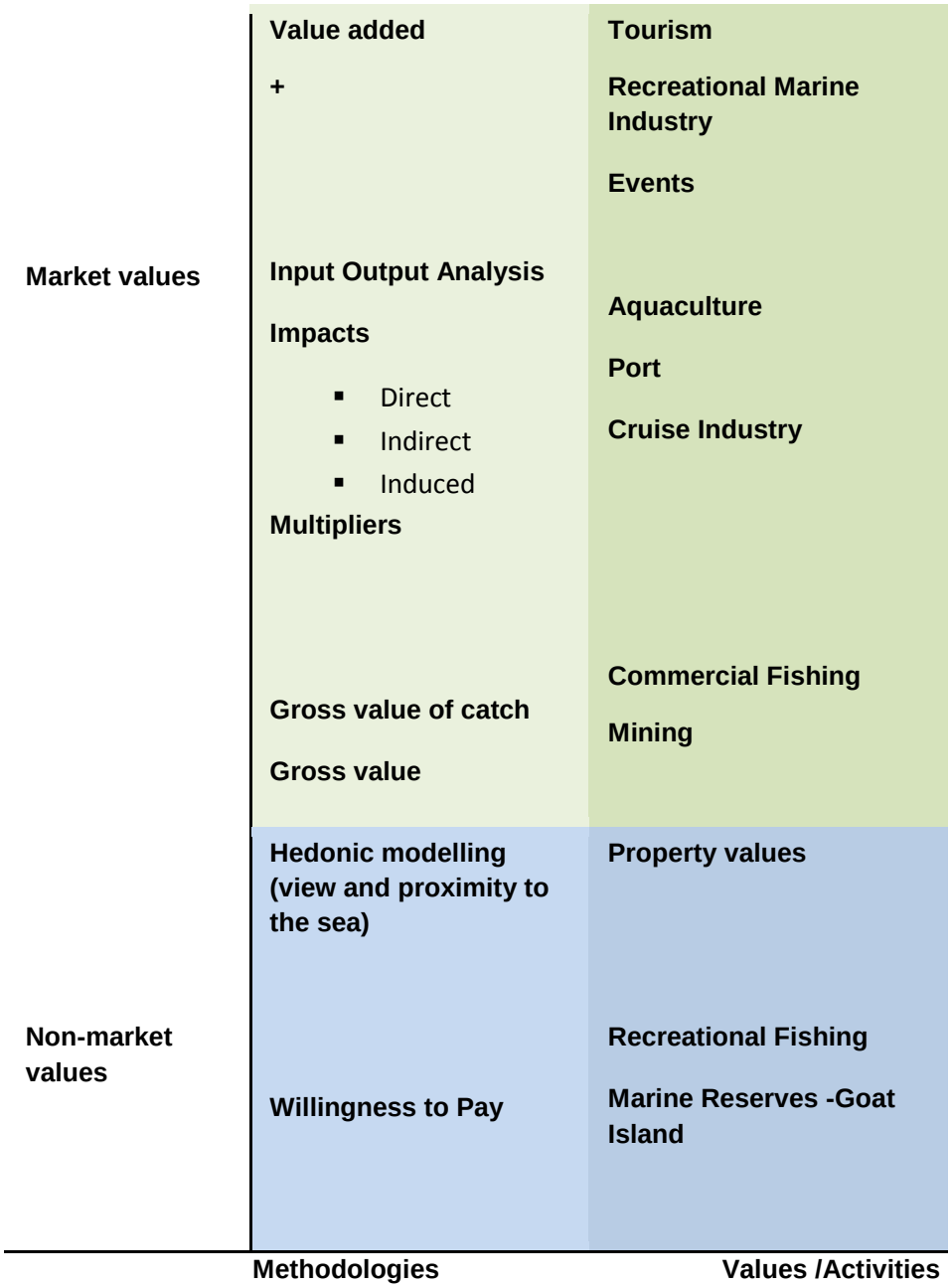
[77] Rohani, M., 2012. See also Filippova, O., 2008, and Samarasinghe, O.E. & Sharp, B., 2008.

[78] Auckland's property was valued at $354 billion in October 2011 by Auckland Council. If (i) approximately 20% of the properties enjoy benefits (view, proximity) provided by the Hauraki Gulf, and (ii) 20% of their value would then be attributable to that, and (iii) that stock value would be transformed into income by considering a 20-year homogeneous flow, then the result could be $700 million per year, only for Auckland.

4.3 Benefits and Methodologies

Figure 11 shows a categorisation of benefits and activities based on market and non-market values and the methodologies used to assess their value. In turn, the value has been interpreted as the economic impact and expressed in terms of values added, i.e. contribution to GDP.

Figure 11. Assessed values and methodologies in the Hauraki Gulf



At a first glance, it is clear that the vast majority of the benefits are derived directly from the market: tourism, recreational marine industry, events, aquaculture, port, cruise industry, commercial fishing and mining[79]. Which is not surprising, given the economic focus of the first phase of this research. In some cases, the economic impact of these activities takes into account mainly their direct impact, while in others the multiplier

[79] Again, this is not disregarding the other values, but just a result of the first phase scoping.

effects of indirect and induced impacts have also been accounted for through the application of input-output coefficients.[80]

For non-market values, willingness to pay (recreational fishing and marine reserves) and hedonic price modelling (property values) methodologies have been used.

Figure 11 shows a matrix of the values of the Hauraki Gulf identified in this study relating them with the methodology that has been used in order to estimate their value. For market values, the contributions to GDP of each activity has been assessed (Tourism, Recreational Marine Industry, and Events), in some instances (Aquaculture, Port and Cruise Industry) adding also multiplier effects through input-output modelling. In the case of Commercial fishing, GDP contribution has been calculated from the gross value of catch; gross value of production has also been used to assess mining activities. In the case of non-market values, contingent valuation (willingness to pay) has been used for recreational fishing and one marine reserve. For the impact of view and proximity to the sea on property prices, hedonic modelling is being implemented.

The methodologies are presented and discussed in detail for each individual activity in the following sections.

4.4 Different Value Perspectives and the Emergence of an Eco-Cluster

It is difficult to underestimate the environmental, economic, cultural and social values provided by the Hauraki Gulf. From a very broad perspective, the value of the Hauraki Gulf could be seen as the sum of all the values it surrounds and embraces. However, this answer would be comprehensive as well as vague. Notwithstanding, this first phase of the investigation limits itself to the direct interaction between the economy and the Gulf and quantifies the benefits in terms of value added.[81]

Error! Reference source not found. presents the monetary values of each of the activities assessed so far. It is necessary to bear in mind that these values are not homogeneous and comparisons should be made with caution. They do not refer to the same year (see the second column of

Table 9), present various inconsistencies, are the result of different valuations techniques, assumptions and could be not mutually exclusive.[82]

In general, it is likely that the values presented are an underestimation of the Hauraki Gulf contribution to the economic activity, given that:

- some values have not been estimated, and
- the main contributors (e.g. tourism) are likely to be underestimated.[83]

To provide a broader picture (to which all the mentioned caveats apply as well), also employment generation assessments have been included in **Error! Reference source not found.**.[84]

[80] For a detailed explanation, see section 2.2.2.
[81] See section 2.
[82] Just to give an order of magnitude, if added up the assessed values could be roughly 4.2% of Auckland's 2010 GDP.
[83] This conservative approach about the valuation of some recreational activities was deliberately chosen in order to minimise double counting and is discussed in detail in each relevant section.
[84] Approximately 5% of the present Auckland's total employment.

Table 9. Assessed economic activities in the Hauraki Gulf[85]

	Year	Direct Value Added $2011million (1)	Indirect + Induced Value Added $2011million (1)	Total Value Added $2011million (1)	Employment (2)	
Tourism	2008	656	281	**937**	15,742	FTEs
Marine Recreational (3)	2008	n.a.	n.a.	**550**	5,781	FTEs
Recreational Fishing	2010	n.a.	n.a.	**81**	n.a	
Aquaculture (4)	2008/2010	49	50	**99**	939	FTEs
Commercial Fishing (5)	2010	41	n.a.	**41**	1,183	FTEs
Ports of Auckland	2008	113	143	**257**	2,027	ECs
Cruise Industry	2009	35	34	**69**	928	ECs
Sand Mining	2010	n.a.	n.a.	**10**	100	FTEs

Notes: **(1)** •direct impacts: initial injections of revenue and expenditure that accrue to that specific sector; •indirect impacts: net increase of economic activity generated by the provision of goods and services to the 'study sector', and •induced impacts: net increase of economic activity due to increased household expenditure in the 'study sector' (see also section 2.2.1). **(2)** FTEs: Full time equivalents, ECs Employment Counts, as defined by Statistics New Zealand. Employment counts are not directly comparable to Full-Time Equivalents (FTEs) as they count equally both full- and part-time jobs. Therefore, they tend to be higher than FTEs.(3) Value added includes some indirect impacts within the marine cluster but not induced impacts. **(4)** Values for Auckland refer to 2008, for Waikato to 2010. **(5)** Including processing.

It can be observed that the major contributor is tourism, followed by the recreational marine cluster, the Ports of Auckland, commercial fishing and aquaculture, recreational fishing and the cruise industry.

Considering that tourism's contribution only accounts for non-residents (foreigners or other nationals) and that almost 35% of the New Zealand's population resides around the Hauraki Gulf, it is clear that this value, though big, is likely to be underestimated as it excludes tourism expenditure of the Hauraki Gulf residents.

From another perspective, the vast majority of the assessed economic values relate to recreational activities – and this is despite residents' benefits having been largely ignored.

From a holistic and ecological perspective, these preliminary results highlight that the Hauraki Gulf's economic activity is only minimally the result of an algebraic sum of competing values or a space where the focus has to be on conflicts and trade-offs.

The picture provided by this exercise, though tentative, shows that not only does the environment underpin all the values realised by humans, but that the relationship between the economy and the environment in the Hauraki Gulf is mainly a synergic one. This means that a thriving ecosystem is necessary to support the economy and a thriving economy is not only compatible with an improved state of the environment, but is a necessary condition to realise the vast untapped economic potential of the Hauraki Gulf.

These preliminary results highlight that the Hauraki Gulf is home to a cluster of economic activities that have the environment at the very core of their value proposition and share a common interest in protecting the

[85] All values include Auckland and the rest of the Hauraki Gulf.

environment as they depend critically on the flow of ecological goods and services provided by the Gulf. These economic activities could increase their value by collaborating more with each other. Therefore, they could be defined as an eco-cluster[86]. The Hauraki Gulf has always been one of the most powerful economic, environmental, social and cultural clusters for Auckland and the Coromandel and its economic relevance could grow if its ecosystems are preserved and the potential of an eco-Hauraki Cluster is clearly identified both by private and public actors.

If we consider that the indentified gaps refer mainly to other recreational, social and cultural values sets, this preliminary conclusion is reinforced and the vision of the Hauraki Gulf as an eco-cluster of values is even brighter.

In summary, the Hauraki Gulf Forum vision of the Hauraki Gulf could be paraphrased as a place which is 'celebrated and treasured', 'thriving with fish, shellfish and kaimoana', has a 'rich diversity of life' supporting a 'sense of place, connection and identity' and *therefore* supports a 'vibrant economy'.

[86] A clearer specification of this eco-cluster will be the object of the second phase of this research project. Michael Porter's definition of a cluster is (Porter, 1998): " geographic concentrations of interconnected companies, specialised suppliers, service providers, firms in related industries, and associated institutions (for example universities, standard agencies, and trade associations) in particular fields that compete but also cooperate". He also points out: "a cluster is a form of network that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions". Therefore, being the Hauraki Gulf, its environment and ecosystem goods and services, the "geographic location" of this cluster, we decided to qualify it as an eco-cluster.

5. Ports, Freight and the Hauraki Gulf

5.1 The Port hence the City – Introduction

The Hauraki Gulf and the Waitemata Harbour provide Auckland with a unique natural feature that determined the presence of human settlements. The first settlers can be traced back to the fifteenth century when Maori settled in Tamaki Makaurau, calling it the place 'where canoes may be tethered safely'.

The quality of the port was the main reason why Auckland became the first post-Treaty of Waitangi New Zealand capital. In 1871 the Auckland Harbour Board was established by an Act of Parliament to administer the port, and in 1875 the Auckland Harbour Foreshore Act was introduced, giving the Board more than 5000 acres of the Waitemata Harbour seabed. Thereafter, the strong demand for better port facilities drove the realisation of substantial infrastructures and reclamations around Auckland's foreshore.

Technological development caused a major change again in the 1960s and 1970s, when the port transformed from a labour-intensive operation towards a capital-intensive one. The first container ship, *Columbus New Zealand*, arrived in 1971, and it was unloaded using 'A Crane', the first ship-to-shore container crane in New Zealand.

The structure of port management and administration changed again in 1988 when the *Port Companies Act 1988* established Ports of Auckland Limited (POAL). Shares in the company were listed on the New Zealand Stock Exchange, with 80% being held by the Auckland Regional Authority and 20% being held by the Waikato Regional Council.

Recently, the Port has added new container cranes, focused on rail and supply-chain solutions and, in 2005, opened the Wiri inland port. Reclamation work has also continued: a $60-million project to deepen the shipping lane and extend the terminal by 9.5 hectares was completed in 2007. The eastwards expansion of the Auckland port has allowed alternative use since 1996 of more than 70 hectares to the west, providing for the Wynyard Quarter redevelopment, which is still under way.

After delisting from the New Zealand Stock Exchange in 2005, the Company today is wholly owned by Auckland Council Investments Limited, a Council-controlled investment company. Ports of Auckland's profits are reinvested by the Auckland Council to support infrastructure projects.

By value of trade handled, POAL is the most significant New Zealand port.[87] In 2010 it handled cargo the equivalent of 13% of the country's total GDP – twice as much as any other New Zealand port. The total container volumes represent 63% of the Upper North Island container trade, 51% of the North Island container trade and 37% of New Zealand's total container trade. The Multi Cargo Facility handles 2.8 million tonnes of bulk and breakbulk (non-containerised) cargo each year, including more than 70% of the total vehicle imports to New Zealand. POAL also provides towage, pilotage and linesman services to more than 1400 ship calls each year.

Auckland is the country's premiere exchange port for cruises, it had 79 cruise ship visits in 2010/11 and 97 calls are projected for 2011/12.

New Zealand is a highly open economy, so trade (imports plus exports) is hugely important, accounting for more than 40% of GDP. The majority of New Zealand's trade is through sea freight (82% by volume, 99% by weight). The Auckland port accounted for 50% of New Zealand's imports and 24% of New Zealand's exports in 2007. Overall, the Auckland ports accounted for around one-third of New Zealand's annual trade.

[87] Ports of Auckland website: http://www.poal.co.nz

Each year,[88] around 1700 freight ships of various kinds call at Auckland (this includes a small portion (2%)[89] at Manukau). Their freight volumes by type are:

- **Container** volumes into and out of Auckland rose 60% from 525,000 TEU containers in 2000 to 841,000 TEU in 2008, and then to 894,000 TEU containers by 2011, with average ship sizes rising correspondingly.[90]
- **Breakbulk cargoes** are fairly steady at around 3.5 million tonnes in 2010/11, of which some 75% is imports (mostly fuel oil, and raw materials for construction and engineering such as sand, cement, steel and gypsum).
- **Vehicles** are the other main freight type, of which 160,000 were imported in 2008.

Based on Covec's figures above, freight tonnages can be estimated as follows:

- **Container:** average container net weight is 10 tonnes, which implies 8.4 million tonnes of container cargo.[91]
- **Breakbulk:** 2.2 million tonnes
- **Vehicles:** at approximately 1 tonne/vehicle, around 1.6 million tonnes by weight
- **Total freight volume:** is therefore around 12 million tonnes,[92] divided as follows based on tonnage:
    - 70% containerised
    - 17% breakbulk, and
    - 13% vehicles.

5.2 Economic Value Assessments

The following sections review the existing valuations of benefits provided by POAL. Three methodologies have been used to estimate the value (economic impact) of the port, namely:

- core activities – direct and flow-on
- facilitated trade, and
- the effect of removing the port.

An evaluation of the value of the port assets is also included.

5.2.1 Methodology 1: Core activities direct and flow-on[93]

In 2008, Ports of Auckland commissioned Covec to estimate the overall economic impact of the Auckland port. It showed that the total impact on the Auckland region was around $144 million of GDP in 2008, comprising $100 million of direct value added (GDP) plus another $44 million of GDP in terms of flow-on effects.

POAL's gross output was assumed to equal its total revenue, $\$_{2008}$169 million, but then flow-on effects were added. Flow-on effects were a combination of indirect effects on other industries (e.g. heavy transport, warehousing) that receive a stimulus from supplying to POAL, plus induced effects of additional household spending by people employed as a result of the direct and indirect effects.

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[88] Covec, 2010. *Economic Impact of the Ports of Auckland, for POAL (as at 2008)*
[89] Market Economics Limited, 2011b. *Economic Role of the Ports of Auckland Limited 2010, 2021 and 2031.* A report prepared for the Ports of Auckland Limited, 11 October 2011.
[90] TEU (twenty-foot-equivalent containers)
[91] Plus tare weight of the empty containers themselves at 2 tonnes each is another 1.7 million tonnes, so total gross tonnage is 10 million tonnes.
[92] Net, i.e. excluding the empty weight of the containers themselves.
[93] Covec, 2010, and Market Economics Limited, 2011a.

In 2011, Market Economics Limited (MEL) recalculated the direct and flow-on impacts of POAL in 2010, with similar results for direct effect but a much higher estimate of flow-on and therefore total effects. They calculated that POAL's port activity (excluding cruise ships) creates:

- total direct output of $207.6 million per year
- direct value added to the Auckland economy of $109.1 million, sustaining 652 jobs (ECs, or 'employment count') annually, and
- flow-on effects from direct value added that generate a further $138.5 million in value added.

So by these calculations, the total impact of port activities on the Auckland economy is $247.6 million in value added, and the generation of 2,027 jobs.

Table 10. Direct and flow-on impacts of POAL, MEL 2010 versus Covec 2008

	Gross Output		**Value Added (GDP)**		**Employment (ECs)**	
	Covec$_{\$2008}$	MEL $_{\$2010}$	Covec$_{\$2008}$	MEL $_{\$2010}$	Covec$_{2008}$	MEL $_{2010}$
Direct	$169 m	$208m	$100 m	$109m	568	652
Flow-on	$101 m		$44 m	$138m	434	1375
Total	$270 m		$144 m	$248m	1002	2027

Note: Covec's benefits do not include trade facilitation or net effects on national economy.

Source: Covec, 2008b; MEL, 2011a.

Future Projections[94]

Based on their Economic Futures Model (EFM), an input-output model of the Auckland economy, Market Economics has projected that POAL's direct output (excluding cruise ships) would grow from $207.6 million in 2010 to a level between $276.6 million and $333.5 million by 2031. This is an increase of 30%–60%. These projections assume that transport and storage activity grows at the same rate as the increase in trade value.

There are proposals for long term expansion and there is currently a study underway to consider the form of fright transport in the upper North Island in future.

5.2.2 Methodology 2: Facilitated trade[95]

In 2011 Market Economics Limited (MEL) took a wider view of the impact of Auckland's ports, using 2010 data and including facilitated trade as well as core activity.

In terms of value of total freight (calendar 2010, $\$_{2010}$), POAL is the most important port in New Zealand, processing $26.4 billion of exports and imports, 37% of New Zealand's total seaport trade, and 31% of trade across all ports (including airports). In 2010 (to the year ending June 2011), Ports of Auckland handled more than 894,000 TEU, i.e. 36% of the national total and the largest in New Zealand.[96]

Much of the freight that flows through Auckland is to and from other parts of New Zealand, so only a portion is associated with the Auckland economy. MEL estimated that in 2010, international trade moving through POAL ("facilitated trade") that was associated with the Auckland economy generated $17.8 billion in gross

[94] Market Economics Limited, 2011b. *Economic Role of the Ports of Auckland Limited 2010, 2021 and 2031.* A report prepared for the Ports of Auckland Limited, 11 October 2011.

[95] Market Economics Limited, 2011b. *Economic Role of the Ports of Auckland Limited 2010, 2021 and 2031.* A report prepared for the Ports of Auckland Limited, 11 October 2011. (This report uses 2010 data, so all figures are in $\$_{2010}$.)

[96] TEU: twenty foot equivalent containers.

output for Auckland, representing value added (GDP) for Auckland of $4.9 billion. Flow-on effects from this generated a further $7.3 billion of value added (GDP) for Auckland for a total of $12.2 billion of value added (GDP) arising from facilitated trade. The total role of the Port in the Auckland economy (i.e. core port activity plus facilitated trade role) is $12.4 billion of value added, sustaining the equivalent of 187,000 jobs.[97] This includes a $248.0 million core port activity and $12.2 billion arising from trade (value added, 2010, ^{2010}).[98] The Port, therefore, plays a role in facilitating almost one-quarter (22.1%) of the total Auckland economy.

POAL also handles international freight to and from other parts of New Zealand. The total role of POAL on the national economy (i.e. core port activity plus trade role, 2010) was to help facilitate $21.4 billion in value added and 335,000 jobs (excluding cruise ships).

Table 11. Direct and flow-on impacts of POAL in 2010

	Value Added GDP $_{2010}$ billion	Facilitated Auckland Employment	Facilitated National GDP $_{2010}$ billion	Facilitated National Employment
Direct	4.9			
Flow-on	7.3			
Total	12.2	187,000	21.4	335,000

Source: MEL, 2011b.

5.2.3 Methodology 3: Effects of removing the port(s)[99]

In 2011 Market Economics Limited looked at the effect of removing the Ports of Auckland. They assumed that POAL's international freight would be diverted almost entirely (96%–97%) through the Port of Tauranga, with a corresponding cost rise (mostly land transport costs) of $18/tonne for POAL's imports and $30/tonne for POAL's exports. This equates to 0.8% and 1% of the value of the imports and exports respectively, but would also result in a direct reduction in volumes traded of 0.4%–1.6% for imports and 2%–5% for exports (low- and high-responsiveness estimates, respectively).

Depending on the responsiveness scenarios chosen, removing the Port from Auckland would cause an annual reduction in trade activity of between $301 million and $874 million in the Auckland area (see Table 9). It is estimated that the trade impact of Ports of Auckland's removal would range between $227 and $660 million worth of economic activity (GDP) in the Auckland economy. This impact equates to between 3480 and 10,109 jobs in Auckland.

The medium-responsiveness scenario is a $587 million direct reduction in Auckland's trade activity (gross output), leading to a $444 million reduction in Auckland's GDP and 6795 job losses. This represents around 0.6% of productive economic activity and employment in the Auckland economy.

Table 12. Estimated effect of removing the Ports of Auckland

Scenarios/ Economic Activity	Low	Medium	High

[97] Excluding cruise ships, which are part of POAL's port activity but not part of the freight activity that we are addressing in this section.
[98] Excluding cruise ships, which would add directly and indirectly $50 million extra GDP for a total of $298 million GDP and 800 extra jobs.
[99] Market Economics Limited, 2011a.

Direct Effects			
Gross output ($\$_{2010}$ million)	301	587	874
GDP or value added ($m)	90	176	262
Employment (ECs)	1251	2442	3634
Flow-on Effects			
GDP or value added ($\$_{2010}$ million)	137	267	398
Employment (ECs)	2230	4353	6476
Total Impacts			
Gross Domestic Product ($\$_{2010}$ million)	227	444	660
Employment (ECs)	3480	6795	10,109

Source: MEL, 2011b.

In addition, POAL's core activity would be lost, which in 2010 (directly and indirectly) generated $248 million in value added (GDP) and supported 2000 jobs for trade activity, plus $50 million in value added (GDP) and 800 jobs for the cruise industry.

The overall impact of removing POAL (including cruise ships) from the Auckland economy would be a combination of the trade and core impacts, as shown in Table 13 below.

Table 13. Impact of removing POAL under the medium-responsiveness scenario (including cruise ships)

	Trade Impact	Core Impact	Total Impact
Direct Output ($\$_{2010}$ million)	587	258	845
Direct GDP ($\$_{2010}$ million)	176	132	308
Flow-on GDP ($\$_{2010}$ million)	267	166	434
Total GDP ($\$_{2010}$ million)	444	298	742
Total Employment	6795	2818	9613

Source: MEL, 2011b.

5.3 A Valuation of the Port Assets[100]

If POAL ceased to operate, then in the short to medium term, most of its assets (excluding the effect of the 2%–4% reduction in trade) would need to be duplicated in Tauranga. The book value of POAL's property, plant and equipment was $604 million as at June 30 2011. (Note that this valuation excludes intangible assets and investment properties). This net book value is after deducting $145 million of depreciation, so full replacement cost would be $750 million. Of the total, $260 million is for land, based on a valuation model determined by reference to its highest and best-use, subject to current zoning. (Market evidence in respect of industrial land values within the wider Auckland area is $150–$1350 per square metre. The average price is $450 per square metre for the 55 hectares.)

The net cost of the transfer would be much less, of course, because the Auckland assets would have a resale value. The movable equipment would be needed in Tauranga, the land and possibly the buildings would have other uses on Auckland's waterfront. Nevertheless, there would be likely to be one-off moving costs, particularly for the plant and equipment.

[100] *Ports of Auckland Financial Report, 2010–2011.*

In the longer term, the cost of replacing capital assets is already included as part of the annual output and value added (GDP) of the core activity.

POAL has 55 hectares of waterfront land valued at a quarter of a billion dollars ($20 million a year at 8% yield) but, if rezoned, potentially worth substantially more in alternative uses. Conversely, it has plant and equipment valued at $350 million ($30 million a year excluding depreciation), of which some portion could probably be sold but much is a sunk cost.

5.4 Concluding Remarks

A large proportion of Auckland's economy is dependent on international trade and in this regard the facilitating role of the Port of Auckland goes well beyond the value added, directly and indirectly, by its core handling activity, even when indirect and induced flow-on effects are included. However, even when this minimalistic approach is adopted, as is the case of methodology 1, this estimate still corresponds to POAL value-adding $250 million per year to Auckland's GDP and 2000 jobs.

Methodology 1, by ignoring the importance of trade, underestimates the economic role of POAL. However, methodology 2, by assigning to the POAL all the values facilitated by its related trading activities, has the opposite bias of methodology 1 and overestimates the value of the POAL, because it does not allow for any alternative 'diverted' scenario.

Methodology 3, which estimates the consequences of diverting all Auckland's maritime trading flows though the Port of Tauranga, could be the preferable estimate of the overall impact of the port (assuming the validity of an input-output multiplier approach). In the absence of POAL, most of Auckland's freight could be rerouted through Tauranga, but the extra transport cost would reduce Auckland exporters' competitiveness by 2%–5% and depress the Auckland economy by nearly $700 million per year of value added (GDP), with a total loss of 9000 jobs in Auckland. (Although 2000 core port jobs would transfer to Tauranga, generating $250 million of value added (GDP) there).

However, considering the scope of this project, methodology 1 as implemented by MEL, i.e. also including national effects, will be adopted in order to value the Ports of Auckland Limited. This choice is based on two main considerations: (i) methodology 1 is the same used for valuing other sectors and activities, and (ii) the closure of the port is not under consideration. Therefore, the following table will be used to aggregate the value of POAL to the total economic value of the Hauraki Gulf.

Table 14. Direct and flow-on impacts of POAL

	Gross Output $_{2011}$million	**Value Added (GDP) $_{2011}$million**	**Employment (ECs) 2008**
Direct		113	652
Flow-on		143	1,375
Total	216	257	2,027

Source: MEL, 2011a.

6. Cruise Ships and the Hauraki Gulf

6.1 An Overview

Auckland is New Zealand's main national and international transport hub; it also concentrates the country's largest variety of urban services and amenities. In fact, Auckland Airport and Ports of Auckland are essential partners for the cruise industry. As a consequence, Auckland is the country's premiere exchange port for cruises, hosting 70 or more calls each year, and is also New Zealand's only winter cruise season port.

Auckland is both a stopover point and an embarking and disembarking port. This generates additional opportunities for the city's businesses to capture the pre- and post-cruise tourism activity.[101] Furthermore, Auckland is where most of the provedoring (provisioning of food and drink), bunkering (refuelling) and airline spend by cruise tourists in New Zealand takes place.

Yet, despite all the above, Auckland is not the place where cruise passengers spend most of their time while in New Zealand and most of the cruise passengers only transit from New Zealand ports.

6.2 Auckland Cruise Industry Structure

Being the main international hub and the major city of New Zealand, Auckland is also the country's main embarkation port for people joining cruises.

Three-quarters of cruise activity (weighted by expenditure) relates to 'large' vessels, with gross registered tonnage (GRT) over 50,000 tons.[102] Virtually all transit passengers travel on large vessels and large vessels account for nearly 90% of port days, which means that port facilities need to be able to handle large vessels. Looking instead at 'exchange' passengers (embarking, disembarking or both), the proportion of those travelling on large vessels is around 65% for international ones and only 10% for domestic exchange passengers (i.e. most New Zealanders are travelling on smaller vessels).[103]

Domestic passengers (i.e. New Zealand residents who take a cruise) mostly undertake winter cruises to the Pacific.[104] They contribute less than 5% of port days for New Zealand ports as a whole (25,000 out of 833,000), but comprise more than 10% of Auckland's port days (14,000 out of 130,000) – see

Table 15.

Crew comprise 30% of port days for both Auckland and New Zealand, meaning that for every 100 passengers in port, there are more than 40 crew.

International passengers account for 60% of Auckland's cruise passengers but spend only 15% of their time in Auckland out of their total time in New Zealand overall. Domestic passengers (i.e. New Zealand residents who take a cruise), spend 60% of their New Zealand port days in Auckland.

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[101] Covec, 2008a, calculated that in 2008 the economic impact of each ship for the local economy was around NZ$1 million.
[102] GRT relates not to actual weight but to volume: a vessel ton is 100 cubic feet.
[103] Market Economics Limited, 2010c.
[104] For New Zealand as a whole, in the 2009/10 year.

Table 15. Port days for Auckland and New Zealand, 2009/10 season

	International Passenger	Domestic Passenger	Crew	Total Person Days	Ship Days
Auckland	76,919	14,442	38,811	130,172	94
New Zealand	555,124	24,612	253,242	832,978	535

Source: MEL, 2010c.

Auckland is where the vast majority of cruise passengers and crew embark or disembark (or both) from a cruise in New Zealand (see Table 16). Still, more than 60% of cruise visitors to Auckland port, as measured in port days, are transiting (e.g. they embark in Hawaii, travel throughout New Zealand and then disembark in Sydney) rather than embarking or disembarking in Auckland. In contrast, the national percentage of only transiting passengers is much higher, at more than 90%.

Table 16. Passenger and crew activity (port days) for Auckland and New Zealand, 2009/10 season

	Embarking	Disembarking	Transit
Auckland	31,390	32,704	133,104
New Zealand	32,616	33,818	836,482

Source: MEL, 2010c.

Despite the fact that Auckland represents the major New Zealand hub for cruise passengers, its share of days that passengers and crew spend in New Zealand is only around 20%.

The Hauraki Gulf islands (see Table 17) do not seem to be considered a significant attraction by major cruise ships as they attract very few cruise ships port days – fewer than 1000 days in 2010 – even in transit, which is less than 1% of Auckland's yearly total port days.

Projections indicate a sizeable, but volatile, increase of visitors to Mercury Island (up to 4000 port days in 2011) and to Waiheke Island (up to 1000 in 2012). The only two other islands visited by cruise ships are Kawau and Great Barrier. However, visitor numbers are very small as they are not targeted by major cruise ships.

Table 17. Vessel and person stop days

	Vessels			Persons		
	2009/10	2010/11	2011/12	2009/10	2010/11	2011/12
Auckland	82	111	159	129,688	184,956	285,189
Waiheke Island	-	1	4	-	35	972
Kawau Island	6	1	-	222	148	-
Great Barrier Island	6	1	-	263	35	-

Mercury Island	2	2	-	156	3979	-
New Zealand	535	595	794	832,978	1,052,450	1,646,768

Source: MEL, 2010c.

6.3 Methodology

In October 2010, Market Economics Limited (MEL) prepared for Cruise New Zealand (CNZ) a study to estimate the overall economic impact of the cruise industry on the various regions of New Zealand, including Auckland.[105]

MEL calculated the total impact on the Auckland region in the 2009/10 season, comprising direct value added (Gross Regional Product, or GRP) plus indirect and induced (flow-on) effects.

The methodology MEL applied, which mirrors the one that was used in the valuation of the other market activities in the Hauraki Gulf and is based on a MEL input-output model, is outlined below:

1. Auckland's share of national cruise activity is identified and split into three categories: (i) vessel related (e.g. port costs, bunkering), (ii) passenger related (e.g. retail expenditure on shore, sightseeing), and (iii) crew related (e.g. retail, recreation).[106]
2. The cruise industry's gross output in Auckland is assumed to equal its **total revenue**, which also includes, for example, the airfares paid by passengers to reach the embarkation port.
3. Overseas payments for airfares and ship fuel are deducted, assuming that most of this spending flows offshore to purchase goods and services overseas. The result is an adjusted figure approximating the local component of direct expenditure.
4. Once these net revenues are calculated, intermediate goods and services are subtracted in order to consider only the value-added component.
5. Flow-on effects are then added. Flow-on effects are the sum of the value added of indirect effects on other industries (e.g. transport, warehousing) that receive a stimulus from supplying to the cruise industry, plus induced effects of additional household spending by people employed as a result of the direct and indirect effects.
6. The final result is then the total regional value added (GRP) attributed to the cruise industry and also jobs created.

In the following sections, the component parts of direct expenditure from the cruise industry will be analysed in detail.

6.3.1 Cruise vessel-related expenditures

This covers all expenditure related to the cruise and the operation of the cruise vessel, including not only the physical presence of the ship and the associated costs, but also cruise-related passenger and crew activity – activities that are directly attributable to the cruises in New Zealand.

In particular:

- spend by vessels on ship-specific expenses of running, berthing and maintaining the ships such as port costs (e.g. berthage, stevedoring, port fees), marine expenses, bunkering (fuel) and maintenance
- spend on passenger flights to join the cruise
- cruise passenger spend on pre- and post-cruise packages and accommodation booked with the cruise
- spend by the cruise lines on various crew-related expenses such as crew exchanges, crew accommodation and re-positioning flights moving crew to and from New Zealand
- spend on provedoring and reprovisioning costs for all passengers and crew while on board, and

[105] Market Economics Limited, 2010c.
[106] These categories will be defined in detail in the next sections.

- spend on onboard entertainment.

6.3.2 Cruise passenger-related expenditures

This covers all incidental expenditure by passengers that occurs as a result of a cruise but is not necessarily part of the cruise itself or directly tied to the activities of the cruise. It includes passenger-related items such as:

- all retail expenditure on shore
- all café and restaurant expenditure on shore
- sightseeing day trips and excursions whilst in port, but excluding those already booked with the cruise, and
- other onshore services such as medical expenses.

6.3.3 Cruise crew-related expenditures

This includes spending by the crew while in port and also before and after cruises on items such as retail goods, personal services, casinos, recreational activities and transport. It excludes spending related to crew changes paid by the cruise lines.

6.4 Economic Value Assessment

According to MEL (2010c), during the 2009/10 season, the Auckland cruise industry direct gross revenue was $167 million, including airfares and bunkering.[107] This equates to around 60% of the total cruise industry direct spend in New Zealand. However, a significant portion of this expenditure (60% for Auckland) flows offshore to purchase imports not contributing to regional economic activity.

Passenger and crew spend reflects closely the pattern of international tourists, as it mainly concentrates in the port cities and focuses on entertainment and sightseeing, retail and hospitality (but less on accommodation than other tourists).

Cruise line and agent spend is more focused on the major interchange ports (notably Auckland) and primarily on berthage as well as servicing and maintaining the needs of the ship and passengers whilst on the cruise.

The total effect of this injection into Auckland's economy was $66.6 million of value added in 2009/10 (see Table 18).

In terms of employment, the cruise industry generated 928 'employment counts' (ECs),[108] 472 directly and 456 through the indirect and induced effects on other sectors.

[107] As previously defined in the methodology.
[108] Employment counts are not directly comparable to Full-Time Equivalents (FTEs) as they count equally both full- and part-time jobs. Therefore, they tend to be higher than FTEs.

Table 18. Auckland region direct, indirect and induced impacts of cruise ships for Auckland, 2009/10 Season

	Gross Output $\$_{2009}$million	Regional GDP $\$_{2009}$million	Employment ECs
Direct expenditure	167.0		
Direct expenditure – adjusted	69.3		472
Flow-on (indirect plus induced)	68.3		456
Total	137.6	66.6	928

Source: MEL, 2010d.

The cruise industry's impact on Auckland's economy (GRP) is detailed in

Table 19, according to the three main expenditure categories:[109]

- passenger-related expenditures = $\$_{2009}$40.2 million (60% of the total impact on GRP)
- vessel-related expenditures = $\$_{2009}$20.7 million (30%), and
- crew-related expenditures = $\$_{2009}$5.8 million (10%).

Table 19. Components of direct, indirect, induced and total impacts of cruise ships for Auckland, 2009/10 season, $\$^{2009}$ million

	Vessel	Passenger	Crew	Total
Direct expenditure	96.5	64.6	5.9	167.0
Less airfares and bunkering	75.2	22.3	0.1	97.7
Direct expenditure – adjusted	21.3	42.3	5.8	69.3
Flow-on (indirect plus induced)	15.7	46.4	6.2	68.3
Total output	37.0	88.7	12.0	137.6
Total value added	20.7	40.2	5.8	66.6

Source: MEL, 2010c.

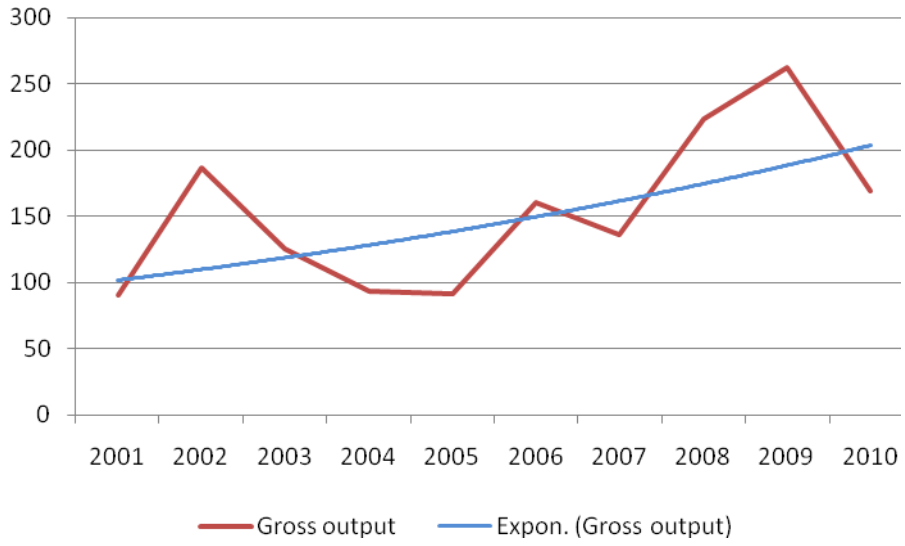
[109] These categories are defined in the methodology.

6.5 Trend and Future Projections

6.5.1 Trend

The cruise industry experiences high volatility with periods of substantial growth or decline. However, the overall trend (see Figure 12) is of substantial growth: the New Zealand cruise industry almost doubled in the last 10 years, a trend that corresponds to 7% compound annual growth.[110]

Figure 12. Cruise industry direct spend, 2001–2010, $[2011] million



6.5.2 Future Projections[111]

Cruise industry activity in Auckland is projected to grow annually by around 2.4%–7.9%, while the 'business as usual' annual growth rate is expected to be around 5.4%.

Under these growth scenarios, the cruise industry would grow from $50.3 million (gross output or direct expenditure) in 2010 (calendar year) to between $83.0 million and $247.4 million in 2031. The 'business as usual' projection for 2031 is $152 million of gross output.

[110] Market Economics Limited, 2010d.
[111] Market Economics Limited, 2011a.

6.6 Concluding Remarks

Auckland's transport infrastructure, amenities and facilities underpin the flourishing of the cruise industry in Auckland and New Zealand. The cruise industry contributed $66.6 million in the 2009/10 season, adding 928 jobs (ECs) to the local economy. Projections indicate strong future growth.

Auckland is the main exchange port for cruise passengers and also the place where they spend most days in New Zealand. However, its share is still only around 17%, which is similar to areas that do not enjoy the advantages of being the main transport hub and the country's largest city, namely Canterbury (14%), Southland (14%), Otago (13%), Wellington (12%) and Bay of Plenty (12%).

Although the Hauraki Gulf and its islands are not usually mentioned as a specific major attraction and are not a significant part of the cruise experience, presumably they form part of the scenic backdrop and available local excursions that help keep Auckland on the international cruise circuit.

Furthermore, the fact that most of the Hauraki Gulf islands do not attract any significant amount of visitors could indicate an untapped opportunity. The Gulf's attractiveness could be increased by improving and better integrating recreational opportunities into the cruise-ship experience.

As the cruise industry is expected to grow significantly, there will be increasing pressure on receiving facilities and amenities of all kinds, including local tourist transport, accommodation and excursions and airport connections, as well as ship berthing and passenger embarkation facilities. As a consequence, a new cruise ship terminal is being planned on the waterfront.

7. The Recreational Marine Sector and the Hauraki Gulf

7.1 Introduction

The New Zealand marine industry builds more boats per capita than any other country in the world and is the largest specialised manufacturing industry in New Zealand.[112] The bulk of the marine industry, servicing both domestic and international clients, is concentrated in Auckland. Auckland generates approximately 64% (or NZ$1222 million) of the total national turnover for the marine industry.

The marine industry is classified as the largest non-primary-product-based manufacturing industry; however, it is evident that it essentially relies on the presence of a natural endowment: the Hauraki Gulf. The waters of the Auckland's Hauraki Gulf provide one of the largest cruising areas in the world and protection from the inclement weather of the South Pacific cyclone season. The fact that the most populous city of New Zealand is located on the shores of the Gulf is not accidental, and the city development shows how the city has been expanding increasingly around its shores. Major international events, along with a strong reputation for the range and quality of services the Auckland marine industry is able to provide, attract super-yachts to Auckland's waters.[113]

The neighbouring regions of Tauranga (Bay of Plenty) and Whangarei (Northland) contribute to the industry through both additional capacity and competition with the Auckland marine industry.

7.2 Physical Infrastructure

7.2.1 Key areas of focus

1. **Westhaven**

   The Westhaven Marine Cluster specialises in refits and maintenance, retail and services, with more than 100 marine companies located in the Westhaven, Wynard Quarter and Viaduct Harbour.

   This area is the focal point for a major urban development project with a vision of a redeveloped and rejuvenated Western Reclamation and Tank Farm; the vision will become a reality over the next 25 years as the area is gradually transformed from a largely port-related industrial area into a mixed-use, multi-purpose urban village.

2. **Hobsonville**

   Development of a dedicated marine cluster at Hobsonville is also underway. Yard 37 is a new 20-hectare marine industrial precinct and will provide comprehensive and essential marine infrastructure complementary to the established marine quarter at Auckland's Viaduct Harbour. It will generate widespread benefits: innovative design and materials, high-technology equipment, luxurious furnishings and skilled labour. Located on the upper Waitemata Harbour, this greenfield site has adjacent deep-water berthage. At Hobsonville there are currently are two boat-building companies and a specialist training organisation.

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[112] Market Economics Limited, August 2008. *New Zealand Marine Industry Survey 2008.*

[113] Recent research by the Marine Industry Association has identified that over a 6-month duration, a super-yacht refit is likely to contribute approximately $880,000 to the local economy. For further information, see Auckland Plus, 2009. *Auckland Marine Industry Feasibility Study*. A report prepared by Beca Applied Technologies Ltd.

3. **Devonport**

   Devonport is home for the Royal New Zealand Navy base, with maintenance capabilities and dry dock facilities, including a 15,000-tonne dry dock. Whilst this facility is focused on the Royal New Zealand Navy, it is also able to provide a range of services to the commercial and recreational sectors.

4. **Other areas**

   There are many other small scale marine industry operations around the Auckland region in addition to those associated with marinas (e.g. Pakuranga, Henderson, Beachhaven and Sandspit).

7.2.2 Marinas[114]

The Hauraki Gulf is also home to a number of smaller-scale marine clusters which provide a range of services and facilities to the marine industry and recreational boat users.

Collectively these marinas provide 5471 berths, 141 pile moorings and 50 swing moorings across the Auckland region. Several of the marinas have haul-out facilities; however, they are all rated at less than 150 tonnes.[115]

According to ICOMIA statistics for 2006, New Zealand marine facilities nationwide provide 205 marinas and yacht harbours, 12,000 berths and slips, 10,000 open moorings, 260 slipways and 15,134 kilometres of sea coastline.[116]

Figure 13. Marinas in Auckland

Source: Google maps.

There are fourteen marinas in Auckland and three in the Coromandel (see section 7.6.1).

Neighbouring and national regions provide additional facilities, labour and capability within the New Zealand marine industry. Auckland's closest regions are Whangarei and Tauranga. Within the Whangarei region, while a few specialist marine companies exist, most marine engineering companies have customers from the broader marine, forestry, and construction and general engineering sectors. Whangarei marine companies service commercial fleets locally and from both Tauranga and Auckland. The Tauranga region has boat-building and repairs and maintenance capability based out of two marinas. While both Whangerei and Tauranga provide additional capability to the New Zealand marine industry, both regions must also address

[114] http://www.nzmarinas.com/
[115] 2008 data.
[116] ICOMIA, 2006. *Recreational Boating Industry Statistics 2006*. ICOMIA, London, UK.

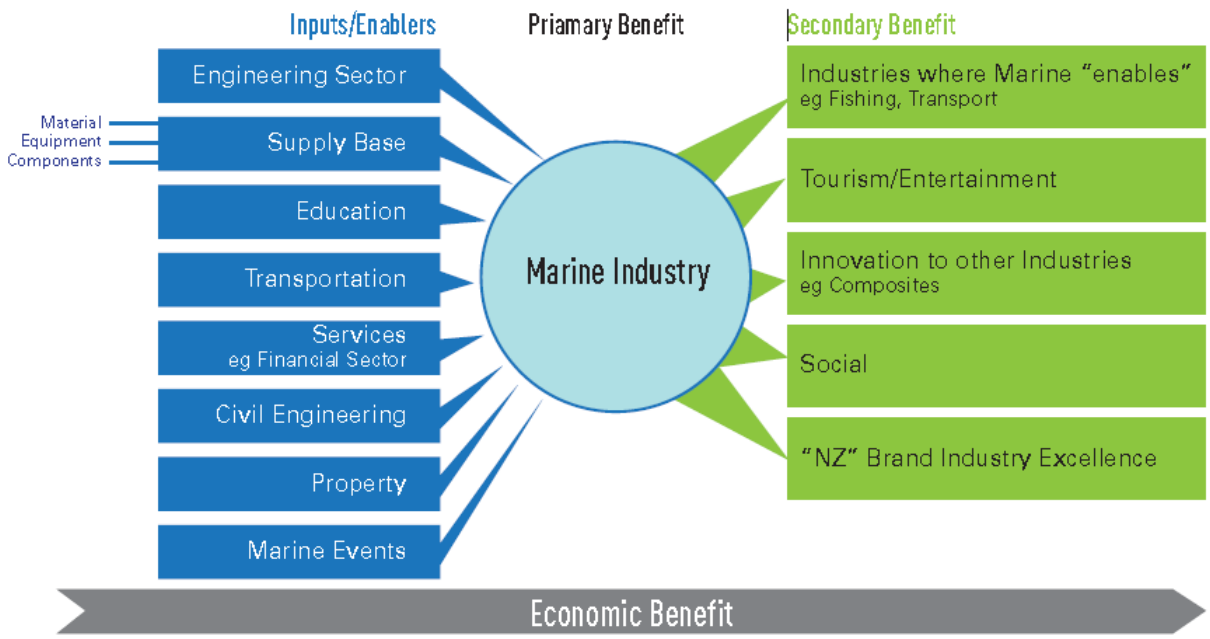
a number of challenges in order to remain operational, with both requiring ongoing dredging. Constraints also arise as a consequence of local infrastructure.

7.3 Methodology

Auckland's recreational marine industry ranges from super-yachts to personal leisure craft, from world-class custom manufacturing to the supply of essential services and consumables.

In addition, Auckland's marine industry supports and is supported by a wide range of industry stakeholders ranging from material suppliers to academic and research organisations (see Figure 14).

Figure 14. Auckland marine cluster



Source: Auckland Plus, 2009.

In 2008, Market Economics Limited (MEL) undertook a study of the New Zealand marine industry, including an assessment of the Auckland industry. The study did not assess the value of the entire marine industry cluster, but only that of the directly related sectors (see Table 17). Therefore, the scope of this valuation is smaller than in those cases (e.g. aquaculture) where indirect and induced impacts have been taken into account.

This approach does not prevent us from valuing those activities (such as events) separately, and is useful in order to avoid double counting problems that could arise if we were not able to understand with enough clarity those indirect and induced impacts.

7.4 The value of Auckland's marine industry

The gross output of the Auckland's marine industry was $1222 million in 2008 (see Table 20).[117] The sector is internationally integrated as 43% of its turnover relates to domestic turnover, 40% for export and 17% for import turnover.[118]

In terms of value added (i.e. subtracting the value of intermediate goods and services used in the production process from the total value of sales), the recreation marine sector represented 0.7% of Auckland's 2006 gross regional product (GRP).[119] Its contribution to Auckland's GDP is projected to increase from 0.7% in 2006 to 0.9% by 2031. For the purpose of this report, we assume a contribution to Auckland's GRP in 2008 of 0.8%, which is approximately $\$_{2008}$513m.

The New Zealand recreational boat category is split into eight sub-categories:

1. **Power Trailer boats**
   A motor boat up to 8.5 metres in length, either on a trailer or in a dry-stack.

2. **Launches and Yachts**
   Any boat, either motor or sail, up to 30 metres in length, moored on water.

3. **Super-yachts**
   Any boat, either motor or sail, more than 30 metres in length.
   Five manufacturers of super-yachts are located in New Zealand.

4. **Racing Yachts**
   A sail boat of any length used for yacht racing.
   Four manufacturers of racing yachts are located in New Zealand.

5. **RHIB and Inflatables**
   Any boat, either motor or sail, using an inflatable exterior ring as part of its hull.
   Seven manufacturers of RHIBs (rigid hull inflatable boats) and inflatables are located within New Zealand.

6. **Refits and maintenance**
   This is the process of repairing, re-equipping or renovating the interior and/or exterior of any boat. The process can be carried out on any boat but the market is heavily influenced by super-yacht refits.

7. **Services, supplies, equipment and component manufacture**
   This category covers a wide variety of services and supplies including but not restricted to specialist design, engineering services, project management, and manufacturing, marketing and sales of propulsion units, winches, anchors, rigging, spars and sails, personal recreational craft and other marine components.

8. **Other**
   This category includes but is not restricted to professional services, marine haulage, crew services, marina operation, consumables, marine retailing, brokerage, charter activity, finance and insurance.

[117] The value of gross regional product plus intermediate consumption.
[118] Total domestic production is comprised of domestic turnover plus export turnover.
[119] ARC, 2009a.

Table 20. Gross output of the marine industry

Marine Database Category	Domestic Turnover			Import Turnover ($million)			Export Turnover ($million)			Total Turnover ($million)		
2008	Auckland ($m)	NZ ($m)	Auckland's % of total	Auckland ($m)	NZ ($m)	Auckland's % of total	Auckland ($m)	NZ ($m)	Auckland's % of total	Auckland ($m)	NZ ($m)	Auckland's % of total
Equipment	130	202	64%	43	72	60%	148	277	53%	320	551	58%
Refits	89	101	88%	–	–	–	29	49	59%	117	150	78%
RHIBs (*)	12	26	45%	20	22	90%	23	24	93%	54	72	75%
Race yachts	8	9	85%	–	–	–	19	39	49%	27	47	56%
Services	193	306	63%	7	7	100%	2	8	29%	202	321	63%
Super-yachts	0	24	0%	–	7	0%	232	249	93%	232	280	83%
Trailer power boats	37	143	26%	32	63	50%	1	16	6%	70	222	31%
Yachts and launches	64	83	77%	103	124	82%	33	55	60%	200	262	76%
Total	531	894	59%	204	295	69%	487	717	68%	1222	1905	64%

Note: (*) Rigid hull inflatable boats.

Source: ARC, 2009a.

7.5 Concluding Remarks

Table 21 summarises the total economic impact of Auckland's marine industry in 2008 in terms of total output, value added and employment. (Impacts include some indirect effects within the marine cluster but not induced effects.)

Table 21. Total economic impact of Auckland marine industry, 2008/09

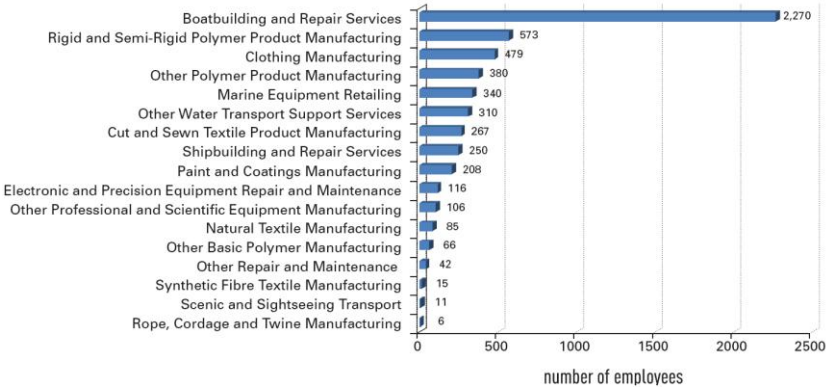
Output ($\$_{2011}$million)	1310
Value added ($\$_{2011}$million)	550
Employment (FTEs)	5781

Source: ARC, 2009a and Infometrics, 2012.

The marine industry's contribution to Auckland's exports is much bigger than its relative value added as it represented up 4.4% of Auckland's exports ($11,091 million) in 2008.[120] In 2008, Auckland's marine industry exports reached NZ$487 million, which is 48% of its total turnover and 4.4% of Auckland's exports. Exports are concentrated in super-yachts (50%), which are built almost exclusively for international use, and equipment (30%).

There are no exact figures for employment in the marine industry as the sector spans many industries and occupation categories. Based on the Marine Industry Association survey of 2008, an estimate of 5781 full-time equivalents was generated for the recreation marine sub-sector in Auckland (see Figure 15).[121] In 2008, Auckland's marine sector had approximately 900 business units and was a significant contributor to the upgrading of the labour force through various training programmes involving more than 600 apprentices; the programmes are co-ordinated by the Boating Industry Training Organisation (BITO), a division of the Marine Industry Organisation.[122]

Figure 15. Employment in Auckland's recreational marine industry, 2008



Source: ARC, 2009a

[120] ARC, 2009a.
[121] ARC, 2009a.
[122] Statistics New Zealand, 2008. *Business Demography database 2008*.

7.6 Appendices to Recreational Marine Industry

7.6.1 Auckland's marinas

1. **Bayswater Marina (**http://www.bayswater.co.nz/)
   Bayswater Marina is located just across the harbour from Auckland City. The marina lies at the end of a peninsula in clear view of Auckland City, with travelling times to the city ranging from 15 minutes by road to 5 minutes by regular harbour ferry. It has 415 full-length finger berths, and all berths are equipped with water and 240 volt power, with earth-leakage protection. Live aboards are welcome year round.

2. **Bucklands Beach Yacht Club Marina** (http://www.bbyc.org.nz/)
   Bucklands Beach Yacht Club Marina is located in Half Moon Bay on the Tamaki River Estuary of the Auckland Harbour. The marina comprises three piers and a floating breakwater adjacent to the larger Half Moon Bay Marina.

3. **Gulf Harbour Marina (**http://www.gulf-harbour.co.nz)
   Gulf Harbour Marina is located on the Whangaparaoa Peninsula. With 1032 berths, it is one of the largest marinas in the Southern Hemisphere. It opens up to the more than 7000 square miles of the Hauraki Gulf. The marina is very sheltered, hidden behind a breakwater and nestled amongst a unique canal housing development and international golf course. Berth sizes range from 10.5 metres up to 50 metres. All berths have a finger alongside for ease of access and have built-in protective fenders.

4. **Half Moon Bay Marina** (http://www.hmbmarina.co.nz/)
   Half Moon Bay Marina is located in the Eastern Suburbs of Auckland, in safe calm waters near the mouth of the Tamaki River Estuary. The marina provides 500 berths plus a full-service haul-out and hard-stand facility; it is capable of storing 180 boats on the hard-stand and in trailer-park areas. The haul-out facility has 35-tonne lift capacity, while the maximum length and beam that can be lifted is 18 and 5 metres respectively.

5. **Hobson West Marina**
   Located in the Viaduct Harbour, the scene of the previous America's Cup, Hobson West Marina is at the centre of Auckland City. Westhaven Marina manages Hobson West Marina.

6. **Pier21 Marina Centre** (http://www.pier21.co.nz/)
   The Pier21 Marine Centre, adjacent to Westhaven Marina, provides a range of choice in vessel storage, maintenance and servicing. It offers (i) 48 marina berths for larger boats (up to 30 metres in length and 3 metres draft), (ii) 190 dry-stack berths in its boat park for smaller craft (up to 9.2 metres), and (iii) a hard-stand boat yard for 30 boats with covered facilities available. The facility has a 50-tonne travel-lift for vessels up to 25 metres, with all services available in near vicinity.

7. **Pine Harbour Marina (**http://www.pineharbour.co.nz/)
   Pine Harbour Marina is largely self-contained, operating 24 hours a day, 365 days a year, with a full complement of on-site tradespeople, 24-hour security system, 24-hour fuel service and a complete haul-out and hard-stand facility. The location of the marina in a unique lifestyle environment, along with its garden-like grounds and family atmosphere, is the major reason for its high occupancy rate. On-site services include chandlery and food supplies, a liquor store, boat painting, boat-building, marine engineering, canopy and squab supplies, stainless steel work and brokerage.

8. **Viaduct Harbour Marina** (http://www.viaduct.co.nz/marina)
   Viaduct Harbour is a prestigious residential, commercial and entertainment precinct located in downtown Auckland City CBD. It provides 150 berths for super-yachts, local and visiting pleasure craft, and tourist and charter boats, Berths range in size up to 60 metres. Services are at available at the nearby Westhaven Marina.

9. **Viaduct Harbour Marine Village**
   Viaduct Harbour Marine Village marina is New Zealand's premier waterfront destination. Located in the heart of Auckland CBD, it lies within New Zealand's most comprehensive marine service precinct at Westhaven, with a full range of services available. There are 44 berths, ranging from 12 metres to 60 metres, with a controlling depth of 4.5 metres.

10. **Westhaven Marina (**http://www.westhaven.co.nz/)
    Westhaven Marina is New Zealand's largest and oldest marina, and is home to more than 1800 boats ranging in size from 8 metres to 30 metres. Nestled at the base of the Auckland Harbour Bridge, Westhaven offers all-weather protection and sheltered secure moorings, while being located just 3.5 kilometres from downtown Auckland. Adjacent to the marina is New Zealand's largest cluster of marine-related businesses, including sail-makers, yacht riggers, haul-out yards, engineers, boat-builders, brokers, electricians, painters and chandlery stores.

11. **West Park Marina** http://www.westpark.co.nz/
    West Park Marina, also known as the West Harbour Marina, is situated in Auckland's upper Waitemata Harbour, west of the harbour bridge and a short distance via Highway 16 from the Auckland CBD. It is enclosed by rock breakwaters on all sides, making for a very sheltered environment in all weathers. It offers haul-out (up to 35T).

12. **New Zealand National Maritime Museum (**http://www.maritimemuseum.co.nz/)
    The Museum has three heritage vessels which operate out of its own marina. Their crew run a varied range of sailing trips, from 15 minutes up to a few hours, around the Waitemata Harbour.

13. **Milford Marina**
    The Milford Marina is a short cruise up the Wairau Estuary and is home to 220 vessels, mainly of shallow draft. The marina is tidal and access is limited to approximately three hours either side of the tide. Preference is given to residents of the North Shore for permanent berthage. The membership to this incorporated society is $225 and the society operates a waiting list system for permanent berths.

14. **Orakei Marina**
    Orakei Marina opened in December 2006 and is Auckland's newest and premier marina catering for predominantly larger vessels. Situated adjacent to the Royal Akarana Yacht Club on Tamaki Drive in Okahu Bay, Orakei sits opposite North Head and the entrance to Auckland Harbour. The 180 berths consist of wet berths ranging between 12 metres and 40 metres in length.

7.6.2 Coromandel's marinas

- **Pauanui Waterways**
  Pauanui Waterways is located on the eastern coast of the North Island's Coromandel Peninsula, which separates the Pacific Ocean from the Hauraki Gulf. Located in Tairua Harbour on Coromandel's eastern seaboard, the canal housing development comprises 150 private moorings.

- **Whitianga Waterways**
  The Waterways is a new development, located 1500 metres upstream of Whitianga Marina. Whitianga is an established seaside town on the eastern seaboard of the Coromandel Peninsula,

and its harbour has a deep, sheltered entrance which is navigable by large craft, regardless of tide or weather. Upon completion, Whitianga Waterways will have several distinct zones including unrestricted and restricted canals, a small retail zone, a standard (non-canal-front) residential zone and an airport zone, where owners with aircraft will be able to fly in and park their aircraft in their own hangar. Stage 1 of the development has just been completed, with 38 private berths.

- **Whitianga Marina**
  The Whitianga Marina is located within an easy stroll of Whitianga township, and is situated 300 metres south of the Whitianga wharf.

- **KiwiGreen Ltd**

8. Aquaculture and the Hauraki Gulf

8.1 Introduction

Mussel, oyster and finfish farming (aquaculture) and processing are an important part of the seafood industry in the Hauraki Gulf, with marine farms spread throughout the area at Mahurangi Harbour, Waiheke Island, Wairoa Bay, Firth of Thames, Coromandel and Manaia harbours, Port Charles, Kennedy Bay, Whangapoua and Whitianga harbours, and at Great Barrier Island.

Local and central government have identified aquaculture as a growth industry in Auckland and the Coromandel and the Aquaculture Council aspires to achieve an output of $1 billion by 2025.[123]

A number of economic studies have focused on the contribution to regional economies by current aquaculture activities and on future prospects for growth in the respective regions. The legacy Auckland Regional Council (ARC) and the Hauraki-Coromandel Development Group have completed major studies. [124,125]

The government has also passed a number of reforms to spur and support growth of the aquaculture industry. This review will outline the methodology and findings of these economic studies, while recent reforms will be summarised in section 8.5.2. However, assessing the potential effects of these reforms is outside the scope of this review.

8.2 Methodology

The ARC and Waikato studies both use input-output analysis for their economic impact assessments.[126] In general, these assessments recognise that one form of economic expenditure in an industry is income for another industry. Therefore, new economic growth in the aquaculture industry is not contained within the industry, but rather spreads and creates impacts through the economy. These studies identify three types of economic impact that can occur as a result of growth within the aquaculture industry:

- *direct impacts*: initial injections of revenue and expenditure that accrue to the aquaculture farming and processing
- *indirect impacts*: impacts that arise as a consequence of the expenditure within aquaculture farming and processing; for example, provision of goods and services to aquaculture farming and processing, and
- *induced impacts*: impacts of household expenditure that arise due to increased household incomes in the study area.

Direct, indirect and induced impacts also occur in relation to employment.

[123] The New Zealand Aquaculture Council is an incorporated society representing the collective interests of the New Zealand aquaculture industry.
[124] ARC, 2010.
[125] Sapere, 2011.
[126] ARC, 2010, and Sapere, 2011.

Multiplier analysis (an extension of standard input-output analysis) was also used to capture the strength of the linkages between the aquaculture sector and the rest of the economy. The types of multipliers used by both ARC and Waikato reports are:

- *Type I multiplier*: this captures the direct and indirect backward linkage effects associated with direct expenditures. It is summarised by the equation: (Direct Effect + Indirect Effect)/Direct Effect. This type of multiplier captures the net effects of an associated with direct expenditures. It is summarised investment in the aquaculture sector on the production chain (i.e. an increase of *x* in investment creates an impact of *y* in GDP).

- *Type II multiplier*: this is similar to a Type I multiplier but also includes induced effects. The equation is now: (Direct Effect + Indirect Effect + Induced Effect)/Direct Effect. Therefore, it also captures the effect of the increase in household wages and salaries paid to the workers in aquaculture.

When forecasting, both studies assumed a medium-growth scenario of intensification over time. However, the Waikato scenario included a significant development in finfish farming with 6000 tonnes produced per year.

Overall, the methodology of these economic impact assessments follows standard rules and is applicable to the standard limitations of input-output analysis. The findings are summarised in the following section.

The major limitation of this method is that it is a static analysis and the growth paths of the industry are assumptions. Furthermore, input-output analysis does not take into account the opportunity cost of capital expenditure, nor does it fully capture the environmental trade-offs that may have to be made to achieve this growth.

8.3 The Value of Aquaculture in the Hauraki Gulf

8.3.1 Auckland

The contribution to Auckland's GRP of the aquaculture sector in 2008 was $\$_{2004}$28.2 million of value added. In Auckland, the majority of the impact occurs in the processing functions rather than from direct farming. In terms of direct, indirect and induced employment, the aquaculture sector generated 507 FTEs.[127] Aquaculture processing is less labour intensive than farming: it generates 6.53 FTEs per $\$_{2004}$million, while aquaculture farming generates 10.

[127] The type II output and value-added multipliers were 1.49 and 1.67, respectively.

Table 22. Total economic impact of Auckland region aquaculture sector, 2008/09

	Aquaculture Farming Impacts (1)	Aquaculture Processing Impacts (2)	Total Economic Impact
Output ($2004 million)			
Direct	6.6	42.2	48.7
Indirect	4.5	14.2	18.7
Induced	0.8	4.1	5.0
Total	11.9	60.5	72.4
Value Added ($2004 million)			
Direct	3.1	13.7	16.8
Indirect	2.2	6.7	8.9
Induced	0.4	2.0	2.5
Total	5.7	22.4	28.2
Employment (FTEs)			
Direct	66	275	341
Indirect	37	104	141
Induced	4	21	25
Total	107	400	507

Notes: 1. Excludes impacts already captured in aquaculture processing.
2. Excludes impacts already captured in aquaculture farming.

Source: ARC, 2010.

The aquaculture industry has a huge growth potential in New Zealand. In the 2008/09 year, the Auckland region harvested 2648 tonnes of mussels and 890 tonnes of oysters. This equates to 3% of national mussel production and 26% of oyster production. For that period, the region processed nearly seven times the amount of mussels harvested (17,426 tonnes).

The contribution to GRP is comprised of aquaculture farming impacts (approx. 20% of total) and aquaculture processing impacts (80%). The impacts of aquaculture processing are significantly bigger than those for aquaculture farming. Thus, for the region, aquaculture processing is highly significant. The processing facilities are not just important for the Auckland region, but also for adjoining regions' harvests. Therefore, limiting the expansion of aquaculture farming activities in Auckland will not necessarily limit the expansion of the processing activities that in Auckland also rely on scaling effects, concentration benefits and other infrastructural advantages.

Forecast impact

Auckland Regional Council modelled the effects of having moderate expansion of the aquaculture industry. This included the existing farms in the region, plus medium expansions of the industry until 2025.[128] The overall impact of a moderate-expansion scenario suggests that in Auckland, by 2031, there could be up to an extra $170 million ($_{2011}$) of direct GRP stemming from aquaculture, whereas

[128] ARC, 2010, p. 30 'This scenario was developed in consultation with the industry, and involved an expansion of current farming practices, an increase in oyster and mussel farms (1165ha) in intertidal areas. It was assumed that there would be an increase of 137ha for oysters, and 1269ha for mussels, given the preferences of industry and through identifying potential areas for the location of these areas. It was also assumed that all produce harvested within the region would be processed within the region for this scenario.'

in the Waikato, including the finfish farming, the direct GRP could increase to $115 million ($$_{2011}$) by 2025.

Table 23 Estimated impacts on Auckland GRP (value added) for current situation and moderate expansion of the industry (farming and processing)

Scenario Auckland Region GRP (value added)				
Year	**2006**	**2011**	**2021**	**2031**
Auckland GRP ($$_{2009}$thousands)				
Current situation	65,790	74,072	94,089	117,559
Scenario – moderate expansion of aquaculture	65,790	74,080	94,172	117,718
Increase in value		8	83	159
Auckland Employment (FTEs)				
Current situation	602	642	745	853
Scenario – moderate expansion of aquaculture	602	643	746	855

Source: ARC, 2010.

The total economic impacts shown in Table 23 incorporate the overall effects from both farming and processing. The timing of these effects is important, given that benefits are not realised immediately after an expansion, but staged through time. With moderate expansion of the aquaculture sector between 2009 and 2031, value added or GRP would increase by $$_{2009}$159 million, an expansion of 0.14%. Cumulatively, between 2009 and 2031 this would amount to an additional $$_{2009}$1921 million in the Auckland economy, an average of $$_{2009}$77 million per year. This in turn would create an additional 1622 FTEs positions in the regional economy by 2031. As with GRP, this increase is gradual over the years between 2009 and 2031.

8.3.2 Waikato

Sapere (2011) conducted a study on the Coromandel aquaculture sector. A standard economic multiplier analysis, using input-output tables, was used to measure the overall impacts of the sector on the economy. The multipliers include both direct and indirect expenditure effects at both the individual business and wider consumption levels. The data to inform these multipliers was drawn from a wide range of sources, including personal interviews and council-held statistics.

In 2010, the combined impact (direct, indirect and induced) of Coromandel aquaculture on GRP was $$_{2010}$31.4 million; nationally, the impact was $$_{2010}$77.4 million (see Table 24).[129] In 2010, there were approximately 300 FTEs employed directly in the aquaculture industry in the Waikato, with a further 250 employed in other regions outside of the Waikato. The total contribution to employment (direct, indirect and induced effects) was 432 FTEs in the Waikato region and 1193 FTEs nationally.[130]

In the Waikato region, the total contribution of aquaculture to GRP is almost evenly distributed between aquaculture farming and processing. However, the direct contribution differs, with 61% from farming and 39% from processing.

[129] Sapere, 2011. The overall type II output and value-added multipliers were 1.49 and 1.67, respectively.
[130] Sapere, 2011.

Table 24. Total economic impact of Coromandel aquaculture sector on the Waikato region, 2010/11

	Aquaculture Farming Impacts[(1)]	Aquaculture Processing Impacts[(2)]	Total Economic Impact
Output ($_{2010}$million)			
Direct	21.8	26.2	48.0
Indirect	3.9	9.2	13.1
Induced	5.1	5.8	10.9
Total	30.8	41.2	72.0
Value Added ($_{2010}$million)			
Direct	11.8	7.6	19.4
Indirect	1.8	4.5	6.3
Induced	2.7	3.1	5.7
Total	16.3	15.2	31.4
Employment (FTEs)			
Direct	121.1	176.3	297.4
Indirect	10.5	62.0	72.5
Induced	26.3	36.0	62.4
Total	157.9	274.2	432.3

Source: Sapere, 2011.

Table 25. Total economic impact of Coromandel aquaculture sector on the New Zealand economy, 2010/11

	Aquaculture Farming Impacts[(1)]	Aquaculture Processing Impacts[(2)]	Total Economic Impact
Output ($_{2010}$million)			
Direct	21.8	73.8	95.6
Indirect	15.4	34.8	50.1
Induced	11.6	29.3	40.9
Total	48.8	137.9	186.7
Value Added ($_{2010}$million)			
Direct	11.8	22.4	34.1
Indirect	6.4	16.2	22.6
Induced	5.9	14.9	20.7
Total	24.1	53.4	77.4
Employment (FTEs)			
Direct	121.1	430.0	551.2
Indirect	117.7	259.7	377.4
Induced	75.4	189.5	264.8
Total	314.2	879.2	1193.4

Source: Sapere, 2011.

Sapere (2011) provides for growth projections to 2025. The projections assume that by 2025, an extra 640 hectares will be farmed for mussels. Oyster farming will not increase in area, but double in output (due to technology). The projections also assume that new legislation will allow finfish farming, which

will result in the production of approximately 5000 tonnes of kingfish.[131] The results are illustrated in Table 26. This scenario could increase GRP to $96 million by 2025, including an additional $35 million per annum generated by finfish. Nationally, the Coromandel industry could contribute $195 million in GDP with 2775 full-time equivalent jobs.

Table 26. Growth projections of Coromandel aquaculture sector on the New Zealand economy, value added, 2011–2025

Value Added $$_{2010}$$million	**2011**	**2031**
Direct	34.1	90.6
Indirect	22.6	52.5
Induced	20.7	51.8
Total	77.4	194.9
Employment (FTEs)	**2011**	**2031**
Direct	551.2	1294.6
Indirect	377.4	848.2
Induced	264.8	632.2
Total	1193.4	2774.9

Source: Sapere, 2011.

8.4 Concluding Remarks

[131] For the assumptions underlying these projections, see Sapere, 2011, p. 29.

In order to reach a valuation of the total economic impact of the aquaculture sector in the Hauraki Gulf, we have partially reconciled the values provided for the Auckland and Waikato regions.

The results are presented in Table 27. Dollar values are now expressed in $\$_{2011}$, while employment values are unadjusted.

Table 27. The total national economic impact (valued added) of the aquaculture sector in the Hauraki Gulf: forecast for 2010–2025 of direct, indirect and induced impacts

Value added GDP $\$_{2011}$million	**2009 Auckland 2010 Waikato**	**2021 Auckland [3] 2025 Waikato**
Waikato total GDP– 2010 [1]	64.2	161.7
Auckland total GDP – 2009 [2]	34.4	49.7
Total	98.6	211.4
Employment (FTEs)		
Auckland	507	746
Waikato	432	1,190
Total	939	1,936

Notes: 1. In order to avoid double counting, the Waikato value represents 80% of the value assessed by Sapere, 2011, as approximately 20% of the Waikato production is estimated to be processed in Auckland.
2. Auckland farming contribution is only $\$_{2011}$14.5 million.
3. From ARC, 2010, moderate-expansion scenario.

Source: Sapere, 2011; ARC, 2010; Auckland Council.

In 2009/10, the total national economic impact of the aquaculture sector in the Hauraki Gulf was estimated to be $\$_{2011}$98.6 million, of which two-thirds originated in the Waikato and one-third in Auckland. These direct, indirect and induced activities generated 939 FTEs. Forecasts, with both different periods and assumptions, suggest that the sector could more than double (+114%) in the next 15 years, with employment increasing by almost a thousand FTEs.

8.5 Appendices to Aquaculture

8.5.1 Multi-criteria analysis of alternative aquaculture scenarios for the Auckland region.

Methodology

Enveco was commissioned by the Auckland Regional Council (ARC) to provide additional comparative information on aquaculture effects.[132] The aim of the report was to consider the potential social, economic, environmental and cultural effects (the 'quadruple bottom line') of three indicative aquaculture scenarios in the Auckland region:

- Scenario 1

  A baseline scenario reflecting currently operating oyster and mussel marine farms.

- Scenario 2

  An expansion of current farming practices to 2025 mainly focused on oyster and mussel farms, but also allowing for 18 hectares for experimental species and finfish. The biggest expansion lies in mussel farming with more than 1000 hectares of additional space envisaged (primarily in the western Firth of Thames).

- Scenario 3

  An expansion of scenario 2 with the addition of four indicative co-culture areas in mid to deep waters. It involves an additional 1839 hectares of mussels and oysters, and 300 hectares of new experimental species, scallop spat-catching and finfish.

A qualitative multi-criteria analysis (MCA) can reliably compare impacts upon quadruple bottom line (QBL) categories but applies expert knowledge and professional judgement rather than numerical data. ARC and Enveco developed a set of indicators and definitions reflecting QBL effects. Indicator development took several months to allow for a robust ranking of effects.

Results

Applying the qualitative MCA approach, all three scenarios show negative environmental effects overall, with these effects intensifying as development increases. However, the three scenarios contribute positively to the economy.

When taking into consideration the scope of the social indicators, excluding the economic aspects of social effects, none of the scenarios exhibit positive outcomes.

Scenarios 2 and 3 perform well with regard to cultural (Maori) economic opportunities, whereas scenario 1 does not create any real opportunity for Maori to advance economically.

Before application of the sensitivity analysis, the MCA revealed scenario 2 to be the preferred option, followed very closely by scenario 1.

The strengths of scenario 1 lie in the fact that all effects are known with relative certainty and that there would be minimal expansion and development. Workshop participants were most confident about the assessment of this scenario in all ranking categories. Consequently, because there is minimal development under scenario 1, the only overall positive effect this scenario demonstrates is

[132] The full report can be read in Enveco, 2010. *Aquaculture Quadruple Bottom Line Assessment Multi Criteria Analysis for the Auckland Region.*

on the economy, but it is not significant. The MCA indicates that scenario 1 is 'as good as it gets' within the current policy framework.

Scenario 2 exhibits positive outcomes for both economic and cultural well-beings. Effects on the social and environmental categories are negative.

Scenario 3 has the most uncertainty, predominantly in the environmental category.

Evaluation of the findings

The MCA has the ability to shed light on the many complex interfaces of aquaculture, and essentially provides a comparative analysis between scenarios, rather than a comprehensive understanding of the magnitude of individual effects.

It also provides more flexibility than a CBA, and is more comprehensive in its coverage. However, it relies on professional judgement rather than the gathering, assessment and application of numerical data. This influences the appropriate end use of the results, which are to be taken as indicative only, and the main findings should be applied with caution.

The limitations of a MCA include the reliance on the opinions of experts based on their knowledge, and the qualitative nature of the rankings and their further analysis. The findings of this particular study were also constrained by the limited available data on the scale, intensity, duration and, in particular, likely future ability to mitigate environmental effects. This difficulty was to some extent mitigated by the use of a sensitivity analysis.

Any form of analysis is also limited when it attempts to forecast effects over extensive time frames such as 25 years, which adds a considerable degree of uncertainty.

8.5.2 Legislation

The *Aquaculture Legislation Amendment Bill No. 3* was passed on 16 August 2011 and came into effect on 1 October 2011. It amends four acts: the *Resource Management Act 1991*, the *Aquaculture Reform (Repeals and Transitional Provisions) Act 2004*, the *Maori Commercial Aquaculture Claims Settlement Act 2004*, and the *Fisheries Act 1996*.

The key changes made by the reform essentially remove some barriers under the RMA. It also increases the minimum resource consent to 20, to provide certainty to the industry. The aquaculture minister has the power to gazette changes into regional coastal plans. The legislation also allows for a new 300-hectare finfish block in the Waikato. Overall, these changes are designed to increase investment and uptake in the aquaculture industry.

The key changes made by the reform are summarised below.

Aquaculture planning and consenting

- Removes the requirement for an AMA (Aquaculture Marine Area) to be in place in the coastal plan before a marine farming consent application can be made. Applying for consent now becomes a normal RMA process.
- An increase of the minimum duration for a resource consent to 20 years., but a shortened lapse period from 5 to 3 years if the consent is not used. This gives the industry some surety for investment and addresses claim-staking with non-development.

- Aquaculture cannot be a ‘permitted activity’ as it must be assessed for undue adverse effects on fisheries (UAE test). A ‘pre-request aquaculture agreement’ may be made between an applicant and affected quota holders. The agreement percentage for all quota holders has dropped from 90% to 75%. If an agreement is made, the Minister of Fisheries does not assess the effects, although councils still have an obligation to assess effects on fisheries from resource consent applications.

- It is now possible to request a private plan change to uplift a prohibition on aquaculture and have it heard jointly with a consent application, allowing applicants to create a zone and consent for aquaculture in one step.

Managing occupation of space for aquaculture in the coastal marine area

- Now that the reform has removed the requirement for consents only within AMAs, the primary process for allocating space for aquaculture activities returns to being ‘first in-first served’, which triggered the original (2001–2004) law reform.

- Mechanisms introduced in 2004 that allow for public tendering in cases of applications with high or competing demand have been retained.

- Other processes require specific provision in the coastal plan or approval of the method by the Minister of Conservation when requested by a regional council.

- Councils may ask the Minister of Conservation to approve allocation by Gazettal for any activity in the coastal marine area, not just aquaculture. This allows for a comparison between activities proposed for the same area or nearby areas with regards to cumulative effects or inter-activity effects.

- Councils may ask the Minister of Aquaculture for a stay on new applications for up to 12 months for specific aquaculture activities, where there is high or competing demand and where the coastal plan is not effective in addressing the demand.

- Councils may ask the Minister of Aquaculture to direct that applications are processed and are heard together to assess cumulative or inter-activity effects.

Frozen applications

The applications which were lodged but not notified before the moratorium in 2001 and which had been ‘frozen’ will now be able to be processed with the exception of those applications for spat-catching in the western Firth of Thames. Conditions have been set on these applications which do not allow these applications to be processed until 1 January 2015 unless requested by the applicants. The other unfrozen applications will be deemed to be lodged on ‘Day One’ of the new legislative amendments, processed in the order they were originally received.

Ministerial powers for making aquaculture regulations

The Minister of Aquaculture has powers to recommend changes to a coastal plan about aquaculture management. This can result in the Governor General being requested to gazette the changes which are then directly inserted in the coastal plan. Auckland Council specifically opposed this new proposed power in its submission on the Bill. However, there is provision for consultation with the affected council, iwi authorities, and the public.

Changes in Waikato Coastal Plan

The Waikato Coastal Plan will change to increase the range of species, including finfish. For Waikato this includes the new 300-hectare finfish block and the ability for farms to change species.

Maori Commercial Aquaculture Claims Settlement Act 2004

- Under the 2004 reforms, 20% of AMA space was allocated to iwi. Now that AMAs are not required, other allocation mechanisms are provided.
- The Crown is responsible for delivering the settlement.
- The 20% allocation stands and is delivered regionally through agreements between the Crown and iwi.
- Te Ohu Kai Moana, as trustee, receives the deliverables and allocates to iwi.
- The allocations are not an actual 20% slice of each case-by-case coastal permit.

9. Fishing and the Hauraki Gulf

9.1 Introduction

9.1.1 The Exclusive Economic Zone (EEZ) [133]

New Zealand has a vast extended continental shelf seabed and the world's fourth largest Exclusive Economic Zone (EEZ), extending 200 nautical miles around its coasts and covering 14 times the size of its land mass.[134] The marine environment contained in the EEZ is made up of many diverse ecosystems and more than 16,000 marine species, many of which are endemic to New Zealand (see Table 28). Despite this, this area contributes only approximately 1% of total global fish production as most of it is considered to be commercially barren due to its extreme depth and lack of nutrient-rich currents.[135]

In the year ending September 2009, total fish exports were 256,854 tonnes, a 12% increase from 230,351 tonnes in 2000. In 2009, fish exports contributed $1425 million in earnings to the New Zealand economy, a 6% increase from $1350 million in 2000. Table 28 provides information about the New Zealand marine fisheries.

Table 28. New Zealand marine environment, Quota Management System and commercial fisheries, 2010

Environment	
NZ marine fisheries waters (EEZ and Territorial Sea)	4.4 million km²
NZ coastline	15,000km
Marine species identified[1]	16,000
Species commercially fished[2]	130
Area closed to bottom trawling (fisheries restrictions)	
Territorial Sea	17%
Exclusive Economic Zone	31%
Primary productivity	Moderate with some high
Ecosystems	Diverse
Climate	Sub-tropical to sub-Antarctic

Source: Ministry of Fisheries website, 2012.

[133] Mostly derived from Statistics New Zealand, 2010.

[134] This right has been confirmed by the United Nations Commission on the Limits of the Continental Shelf. This extended continental shelf is in addition to the approximately four million square kilometres of seabed in the New Zealand EEZ and is about six times New Zealand's total land area (about 270,000 square kilometres). The New Zealand Government already earns more than $100 million per annum in royalties and other income from the seabed within the Exclusive Economic Zone (EEZ). Source: New Zealand Ministry of Foreign Affairs and Trade.

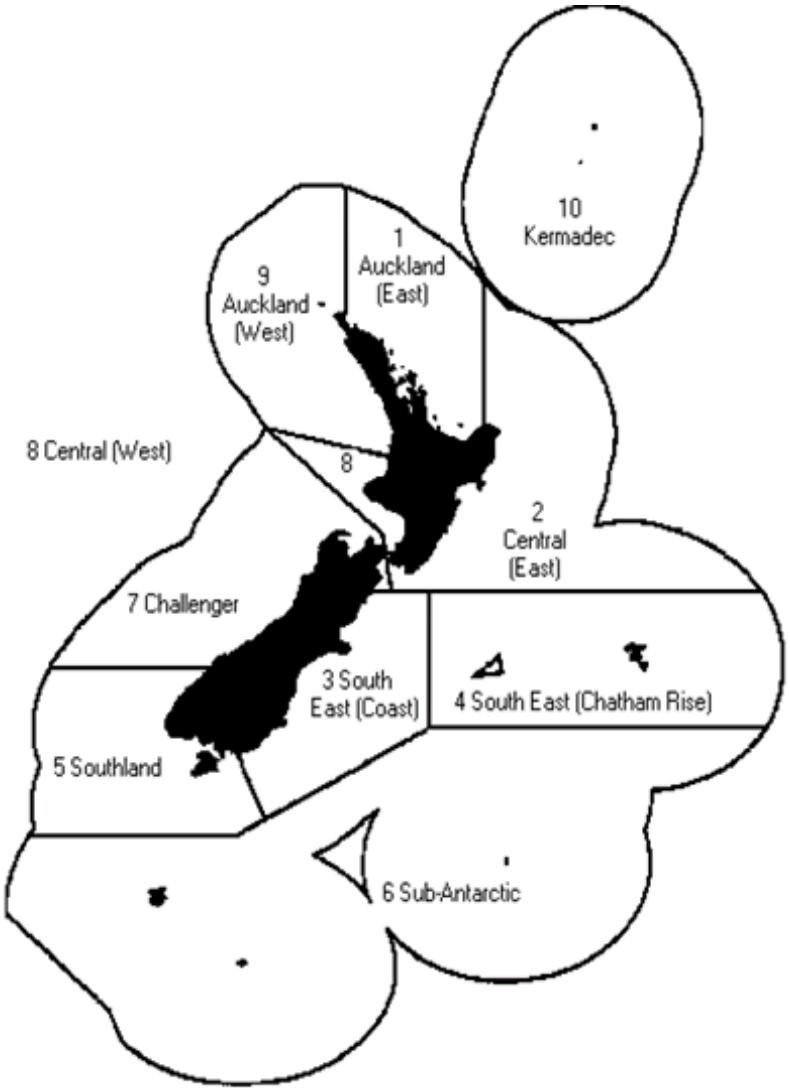
[135] Food and Agriculture Organization of the United Nations (FAO), 2005; Newell, Sanchirico & Kerr, 2002.

9.1.2 The Quota Management System

In the early 1980s, unregulated fishing produced an environmental crisis. This resulted in the introduction, in 1986, of the Quota Management System (QMS), which transformed a public good into a private good, by creating new harvesting rights.[136]

The QMS divides New Zealand's EEZ into 10 fisheries management areas (FMAs) (see Figure 16).

Figure 16. **New Zealand Fisheries Management Areas**[137]



Source: Ministry of Fisheries.

[136] For a discussion on public versus private goods, see section 2.1.1.
[137] Management areas may vary between species.

Table 26 provides figures about the New Zealand Quota Management System and commercial catch.

Table 29. New Zealand Quota Management System 2010

Quota Management System (QMS) stocks	
Species/species complexes in QMS	97
Individual stocks in QMS	633
Proportion of catch (by weight) from assessed stocks	72%
Assessed stocks at or near target level	67.5%
Allowable commercial take (TACC)	599,126 tonnes
Actual commercial catch	409,449 tonnes

Source: Ministry of Fisheries website, 2008.

Each species' fish stock has been assessed in order to identify the respective sustainable quota. Each fish stock is defined by a quota management area (QMA). This QMA may be the same as an FMA or a grouping of FMAs, depending on the geographical distribution of that fish stock.[138]

Under the QMS, commercial catch limits (in tonnes) are set annually for each fish stock by the Minister of Fisheries, as total allowable commercial catch (TACC).[139]

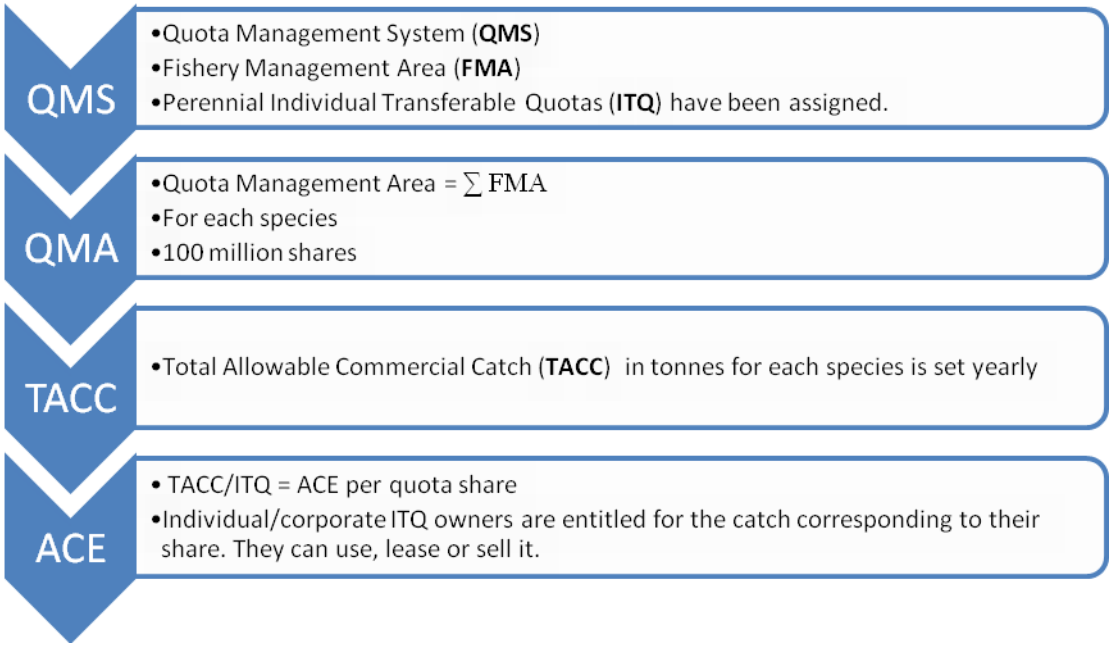
Under the QMS, commercial fishers now own individual perennial transferable quotas (ITQ). Therefore, once the TACC has been established, the respective individual or corporate annual catching entitlement (ACE) is derived. Both the ITQ and the ACE are also transferable (can be bought and sold).[140] An ACE can be sold multiple times before it is actually fished.

[138] For example, snapper has a fish stock called SNA1 that matches FMA1.

[139] About 130 species are commercially fished within New Zealand's EEZ, 96 of which are managed under the QMS. Catch limits vary yearly and are based on advice from the Ministry of Fisheries and submissions from the fishing industry and other interested groups.

[140] The value of each quota is always 100 million shares. Under the current QMS system, only New Zealand residents can own quota (unless permission is granted by the Minister of Finance and the Minister of Fisheries). Nonetheless, quota owners can contract overseas companies to harvest fish. On the first day of every fishing year that entity's quota shares generate an ACE, which is expressed in kilograms. On allocation, the quota and ACE separate so the ACE can be traded independently of quota. All quota and ACE transfers must be registered with FishServe, a company that provides administrative services to the New Zealand commercial fishing industry. ACE can be transferred up to 15 days after the end of a fishing year to allow catch to be 'balanced' up to the end of the fishing year.

Figure 17. Commercial Quota Management System

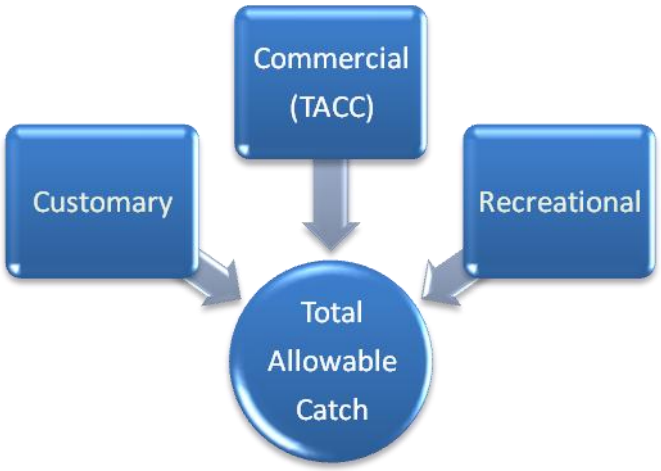


According to Boyd Fisheries Consultants, based on the quota values given in the Fish Monetary Stock Account,[141] 'the present market value of the individual transferable quota rights required to take the 2010/11 commercial finfish catch from the waters of the Hauraki Gulf Marine Park is in the order of $130 million. Snapper takes about 80% of this total.'[142]

In order for the TACC to be sustainable, the Ministry of Fishery has to take into account also recreational (R) and customary fishing (C) and therefore assess a total allowable catch.[143]

Therefore, the Total Allowable Catch equals the Total Allowable Commercial Catch plus the recreational and customary fishing catches: TAC = TACC +R + C

Figure 18. Total allowable catch and its components



[141] Statistics New Zealand, 2010.
[142] Boyd Fisheries Consultants Limited, 2012, p. 14.
[143] These activities are regulated mainly by catch limits (quantity and size).

The Ministry of Fishery publishes an annual report summarising fishery, biological, stock assessment and stock status for each fish stock.

9.1.3 Recreational and customary fishing

The Ministry of Fisheries' *Fisheries 2030* strategic direction has been developed to maximise New Zealanders' benefits from the use of fisheries within environmental limits. This includes the following outcomes for amateur and customary fisheries:

- High-quality amateur fisheries that contribute to the social, cultural and economic well-being of all New Zealanders.
- Thriving customary fisheries, managed in accordance with kaitiakitanga, supporting the cultural well-being of iwi (tribes) and hapü.

New Zealand is divided into three recreational management areas: north, central and south.[144]

Recreational catch is considered by the Ministry of Fisheries as the catching of fish for non-commercial and non-customary purposes and the fish caught cannot be sold. However, fishing tours or trips that are run by a commercial venture are also categorised as recreational fishing.[145]

Table 30 summarises the main national data about customary and recreational fisheries.

Table 30. New Zealand customary and recreational fisheries, 2010

Customary Fisheries	
Tangata Tiaki appointed (South Island)	142
Tangata Kaitiaki appointed (North Island)	307
Temporary closures (s 186)	6
Taiāpure - local fisheries	8
Mātaitai reserves	10
Customary take provided for within the TAC	4,813 tonnes
Recreational Fisheries	
Estimated participation (as a % of the total NZ population)[8]	19.5 %
Estimated annual take	25,000 tonnes

Source: Ministry of Fisheries website, 2008.

[144] Each area has specific regulations that apply to different fish stocks.
[145] There is no requirement to report recreational catch.

9.2 Commercial Fishing in the Hauraki Gulf[146]

Commercial fishing is an important sector for the New Zealand economy; it generates around 3% of total export revenues and total employment, i.e. more than $1.4 billion and employment of 5680 people in 2009.

Both Auckland and the Waikato benefit from the fishing industry and a number of coastal communities in the area are heavily dependent on employment and earnings from businesses involved in the commercial fishing industry and related services sector. Historically, Auckland and the surrounding areas have relied on the commercial fishing sector within and around the Hauraki Gulf to supply the population with fresh fish and this continues to the present day.

Table 31. New Zealand marine commercial fisheries, 2010

Commercial Fisheries and Aquaculture	
Total seafood export value, 2009 (FOB)	$1.42 billion
Aquaculture exports	$279 million
Total seafood exports, 2009	287,508 tonnes
Total quota value	$4.017 billion
Quota holders	1556
Commercial fishing vessels	1278
Processors and licensed fish receivers	220
Direct employment (full-time equivalents)	5,680

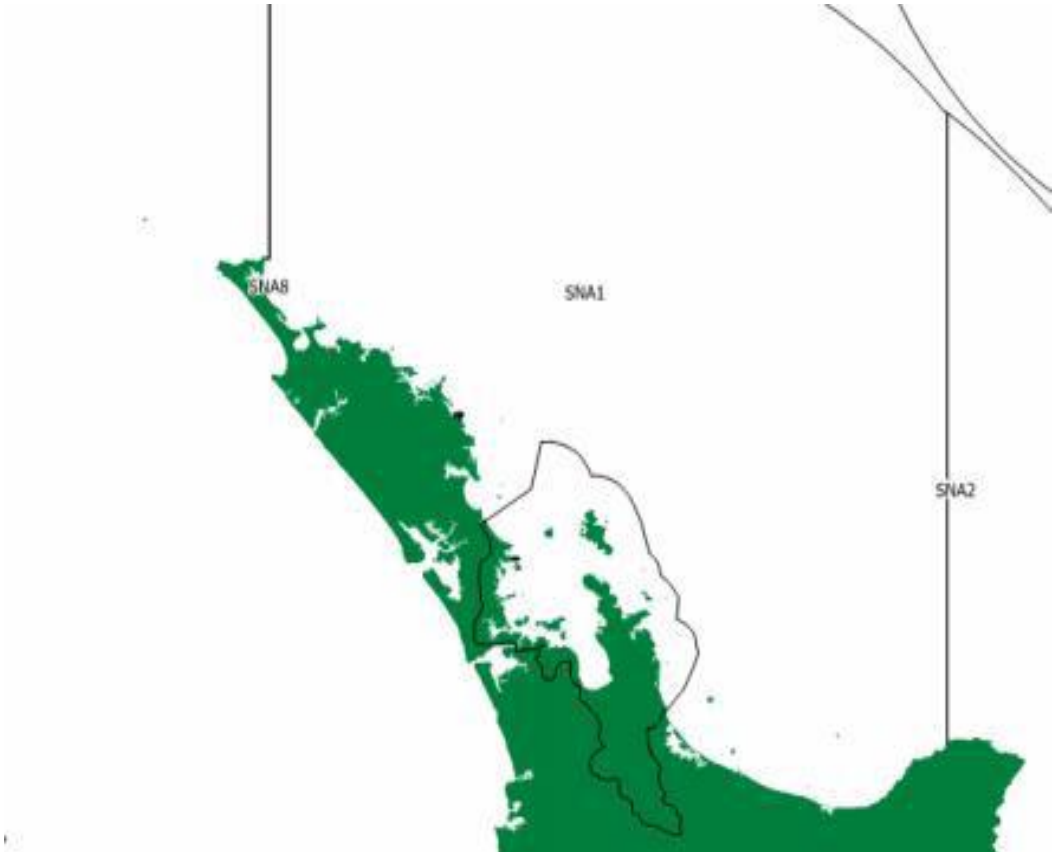
Source: Ministry of Fisheries website, 2008.

Although the Hauraki Gulf Marine Park area covers only a minor portion of the fish management areas of most fish stocks found along the northeast coast of the North Island, it is a very intensively exploited area, both by commercial and recreational fishers.

For example, the HGMP includes only a small part of the stock boundaries for snapper (SNA1) (see Figure 19); however, approximately 50% of the total commercial catch of snapper from the SNA1 stock has come from the HGMP area.[147] For recreational fishing instead, it is estimated that approximately one-third of the recreational catch takes place in the Hauraki Gulf.

Figure 19. Location of the Hauraki Gulf Marine Park within the QMS FMA for snapper (SNA1) [148]

[146] Mostly derived from Boyd, 2012.
[147] Boyd, 2012.
[148] Boyd, 2012.



9.2.1 Commercial fishing restrictions in the Hauraki Gulf

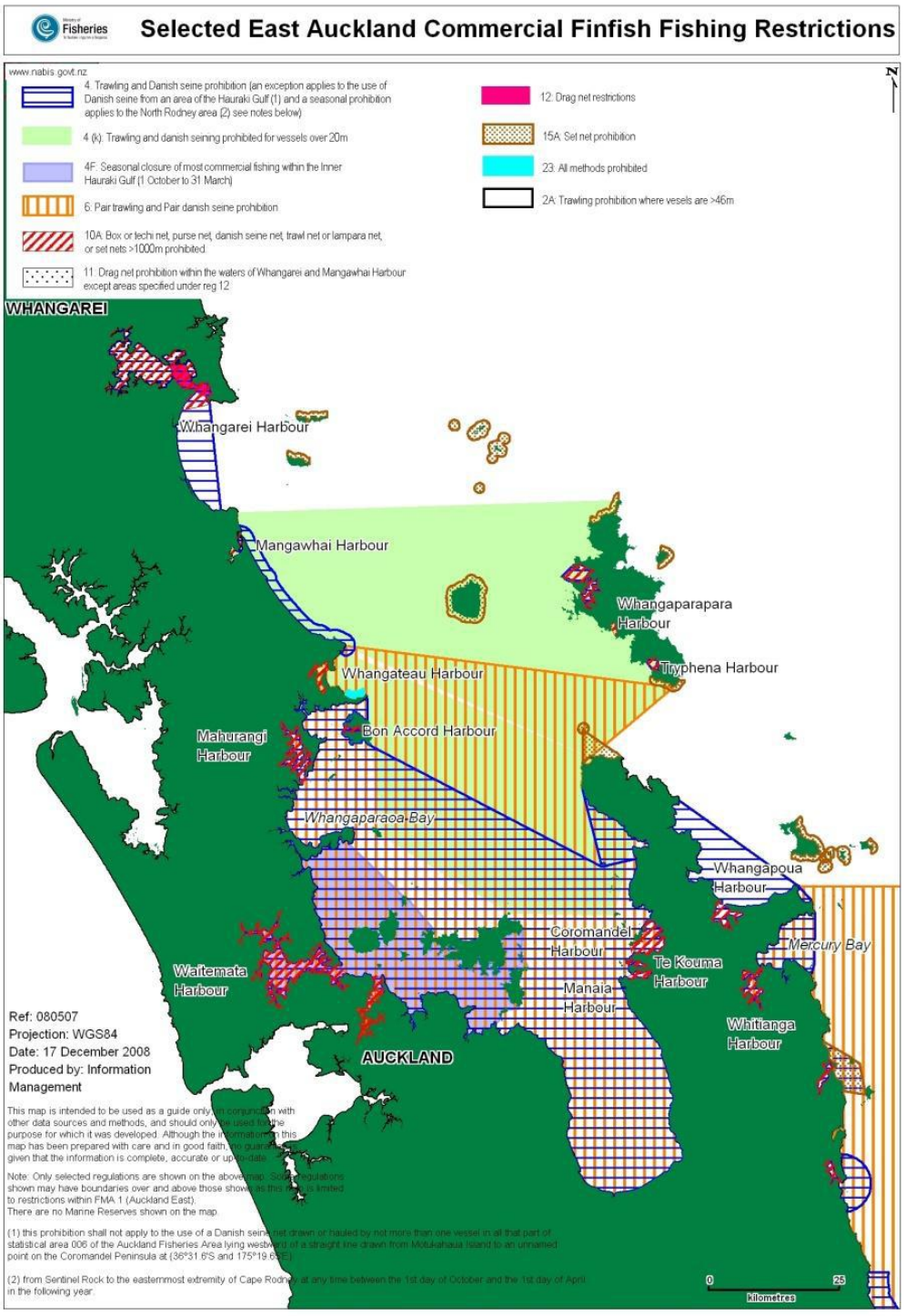
In addition to the QMS, there is a range of other fisheries management regulations that limit and control commercial fishing activity within the waters of the Hauraki Gulf Marine Park. Many of these additional controls pre-date the QMS.[149]

Existing commercial fishing regulations in the immediate area of the Hauraki Gulf Marine Park include various effort controls, which can be seen in Figure 20. However, according to the fishing industry, many of these no longer have relevance as sustainability measures because the catch controls under the QMS make them unnecessary.[150]

[149] For example, the trawl and Danish-seine restrictions in the Hauraki Gulf date back nearly a century. Although there have been minor changes to the trawl and Danish-seine limit lines over the years, most of the Hauraki Gulf waters lying roughly inside a line from Kawau Island to Coromandel have been closed to trawling and Danish seining for nearly 100 years. (Boyd, 2010, p. 5.)

[150] For a list of these controls, see Boyd, 2012, p. 6.

Figure 20. Commercial fishing area restrictions and prohibitions in the HGMP and surrounding area[151]



According to the commercial fishing industry, the excessive restrictions imposed on the industry working in the Hauraki Gulf, combined with the 'unregulated' situation that benefits recreational

[151] Boyd (2012) pg.7

fishing, as well as population growth and technological developments (i.e. fish finders, GPS) unfairly favours recreational fishing interests and could even create a sustainability problem. To support this argument, they quote the 1345 tonnes estimate of recreational snapper catch (2004/05) for the waters lying inside a line from Cape Colville to Cape Rodney and compare this with the 2010/11 commercial snapper catch from the same waters of just over 1100 tonnes. 'The fishing industry believes that the main risk to the sustainability of the snapper stock in the HGMP today is because there is no cap on the total recreational harvest.'[152] However, they also recognise the lack of reliable data on recreational fishing, while 'the commercial catch data is both accurate and up to date'.

The commercial fishing industry also believes that the effect of those restrictions is not improved sustainability. Instead, the industry says, the restrictions only increase the costs of commercial fishing in the Hauraki Gulf and, therefore, they are reducing the economic gains that the QMS was intended to achieve. 'The industry would like to see a rationalisation of the current commercial fishing regulations, especially as they apply in the Hauraki Gulf.'[153]

9.2.2 Economic valuation of commercial fishing in the Hauraki Gulf

In the Hauraki Gulf proper (i.e. the waters inside Great Barrier and Little Barrier islands), there are three main commercial fishing methods: long line, trawl and Danish seine. As clearly shown by Table 32, the main target of commercial fisheries in the Hauraki Gulf is snapper (from a minimum of 72% to a maximum of 94% of total catch), with other species such as gurnard, john dory and trevally the most common by-catch species. Therefore, commercial fisheries in the Hauraki Gulf rely substantially on snapper, as it also the most valuable species per kilogram. [154]

Table 32. Species and commercial fishing methods in the Hauraki Gulf

Species/Fishing Methods	Trawl	Danish seine	Long line
Snapper	72%	74%	94%
John dory	6%	8%	
Gurnard	4%	5%	
Trevally	4%	4%	
Kahawai	-	8%	
Leatherjacket	-		
All other species	4%	2%	6%

Source: adapted from Boyd, 2012.

These three methods only operate throughout the areas of the Hauraki Gulf where they are permitted. Trawling and Danish seining are prohibited within the inner and middle Hauraki Gulf and these two methods therefore operate only in the more exposed waters north of a line from Kawau Island towards Coromandel (see Figure 20). Long-liners fish more widely throughout the Hauraki Gulf, except along the East Coast Bays where there is a seasonal prohibition.

Within the very shallow waters of the inner Firth of Thames and other shallow harbours, small set-net vessels and a few vessels using other passive netting methods mainly target flat fishes, kahawai and grey mullet. Their catch is almost all destined for the local markets of Auckland and Waikato regions,

[152] Boyd, 2012, p. 7.
[153] Boyd, 2012, p. 7.
[154] Boyd, 2012, p. 9.

with the less-expensive species such as kahawai and grey mullet important to low-income communities.

Boyd (2012) does not provide an economic impact assessment of the fishing industry in the Hauraki Gulf comparable to those available for the aquaculture sector. Therefore, it is necessary to elaborate on the data provided by different sources in order to reach an indicative estimation of the value of commercial fisheries in the Hauraki Gulf.

Table 33 provides figures of total catch by species for the 2010/11 season as well as the respective port and export prices.

Table 33. Hauraki Gulf Marine Park commercial fishing by species, 2010/11

Species	Total catch (kg)	Port price/kg	Total landed value	Export value/kg	Total export value
Snapper	2,275,752	$5.35	$12,175,273	$10.39	$23,645,063
Trevally	446,768	$1.75	$783,184	$9.10	$4,065,589
Kahawai	345,026	$0.41	$142,496	$0.97	$334,675
Flatfish	175,846	$3.20	$562,707	$9.61	$1,689,880
Jack mackerel	173,169	$0.20	$34,634	$1.20	$207,803
Gurnard	135,875	$2.15	$292,539	$9.38	$1,274,508
John dory	113,413	$6.66	$755,671	$12.44	$1,410,858
All other species	1,102,573		$2,560,268		$7,584,616

Source: Boyd, 2012.

Boyd Fisheries Consultants (2012), in a report prepared for Northern Inshore Fisheries Management Company, said:

> *In recent years, the snapper catch from the HGMP has made up slightly more than a third of New Zealand's total commercial snapper catch of about 6400 tonnes annually. The Seafood Industry Council estimates that the domestic market takes about a third of the New Zealand snapper catch, with much of this destined for the greater Auckland and Waikato regions. Snapper is also the most important inshore finfish exported from New Zealand, with an export value of $36.9 million in the year ended June 2011 (Ministry of Fisheries, 2011).*
>
> *Overall, the commercial fishery in the HGMP contributes a significant value to the local domestic economy, with much of the catch of fresh fish destined for the local Auckland and Waikato regions. The hospitality sector in particular relies substantially on the supply of fresh fish and shellfish produced by the commercial fishery operating within HGMP waters. The character and reputation of Auckland's waterfront is enhanced by the supply of clean, safe and sustainable seafood from the HGMP. Local residents and international visitors alike enjoy fresh seafood from local waters*.[155]

9.2.3 A tentative valuation

[155] Boyd, 2012, p. 12.

Considering that[156]

- port price is what fishers get paid for landing fish to a Licensed Fish Receiver (LFR); and
- that a consumer purchasing fish for local consumption would have to pay the export price at a minimum as this is the reserve price at the local auction.

Therefore[157], if the LFR can't get above the export price from local buyers the fish will simply be exported.

From the presented figures and considerations, we could deduce that:

- Snapper represents around 85% of the value of commercial fisheries in the HGMP (a proportion derived by considering both volumes and relative price).
- Assuming that 90% of the fish caught in the HGMP is exported[158], the corresponding revenues would be $36,191,693 (as per Table 33 and 34).
- That the remaining 10% is consumed locally and its price is, on average, 20% higher than the export value. Thus, its value would be $4,825,559.

Therefore, as shown in Table 34, the total revenues of commercial fishing in the Hauraki Gulf could be assessed at $\$_{2011}$ 41m.

Table 34. Hauraki Gulf Marine Park commercial fishing by species, 2010/11

	Export Revenues	Domestic Revenues	Total Revenues
Snapper	21,280,557	2,837,408	24,117,964
Trevally	3,659,030	487,871	4,146,901
Kahawai	301,208	40,161	341,369
Flatfish	1,520,892	202,786	1,723,678
Jack mackerel	187,023	24,936	211,959
Gurnard	1,147,057	152,941	1,299,998
John dory	1,269,772	169,303	1,439,075
All other species	6,826,154	910,154	7,736,308
Total	**36,191,693**	**4,825,559**	**41,017,252**

Source: elaboration on Boyd, 2012.

In order to estimate employment generation, information provided by the Ministry of Primary Industries and the seafood industry, based on data from MEL (2008a), allowed us to estimate 821FTEs as the direct employment generation of commercial fishing in Auckland and 362FTEs in Waikato, for a total of 1,183 FTES.

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[156] Ministry for Primary Industry, Feedback on the Total Economic Valuation of the Hauraki Gulf: Phase One Report, Auckland, 24 May 2012

[157] Idem. Only 10% of seafood production is consumed locally (although snapper is a popular species on the local market).

[158] This assumption, based on a national average, could slightly underestimate the value of commercial fisheries in the HGMP given that Auckland is the main New Zealand local market. However, it is also likely that some of the fish is sold locally because of its lower quality and therefore the assigned price premium, would have a partially compensating counter-effect.

9.3 Recreational Fishing in the Hauraki Gulf

The Hauraki Gulf has been an important fishery area since human settlement, yielding a wide range of popular fish species including snapper, kingfish, kahawai, trevally, gurnard, tarakihi and john dory, and shellfish including scallops, rock lobster, cockles, pipi and paua.

The recreational harvest for the waters lying inside a line from Cape Colville to Cape Rodney in 2004/05 included an estimated 1345 tonnes of snapper, 95 tonnes of kahawai and two tonnes of kingfish.[159]

The pressure on fish stocks from recreational fishing has increased. This is mainly related to the region's growing population, income and technological developments (e.g. GPS equipment, improved gearing and boats); commercial activities (i.e. fishing tours) classified as recreational fishing also have direct economic impacts not calculated here. Recreational fishers enjoy a high level of experience (in terms of the availability of fish, and ability to access fishing areas) compared with other countries. Considering that part of the Hauraki Gulf is on the door step of a major city, this access and availability can be considered quite a unique feature for an urban environment.

Determining the value of the recreational fishery is complex as, unlike commercial fishers, recreational fishers do not have to provide any official records of their catch. Information collected and used to estimate catch sizes is based on aerial, boat-ramp and telephone surveys.[160] Therefore, in order to value the fish, non-market valuation techniques have to be employed.

In 1999 a willingness-to-pay (WTP) survey was undertaken to assess the value in terms of consumer surplus,[161] but to date no attempt has been made to value the contribution of recreational fishing to gross domestic product (GDP) at a national or regional level.

This report reviews the currently available information contributing to knowledge of the value of the Hauraki Gulf recreational fishery.

9.3.1 Methodologies applied for the valuation of recreational fishing in New Zealand: description and discussion

In 1999 a contingent valuation study was undertaken to assess the willingness to pay (WTP) of recreational fishers in New Zealand.[162] Information collected from this work was intended to contribute to:

- providing a definition of recreational rights
- characterising the recreational fishing sector
- establishing costs and benefits when bringing new species into the Quota Management System (QMS)
- assisting allocation decisions when setting Total Allowable Catch (TAC), and
- enabling people to provide for social, economic and cultural well-being. [163]

[159] Hauraki Gulf Forum, 2010, p. 14, citing Ministry of Fisheries figures.
[160] Hauraki Gulf Forum, 2010.
[161] Consumer surplus describes the value over and above the market price that consumers would be willing to pay for a good or service, in this case for the fishing experience.
[162] Lindsay et al., 1999.
[163] The survey is cited in Lindsay et al., 1999. See also Williamson, 2000.

In the 1999 study, WTP was determined by asking respondents firstly what they spent on consumables (bait, fuel, ice, etc.) for the current fishing trip, and whether they would be willing to pay an additional *x* dollar for the trip. Focused on the fish species snapper, kingfish, blue cod, kahawai and rock lobster, the information collected was used to estimate:

- the value of the fishing experience
- the value of recreational fish, and
- the amount of expenditure on the five species investigated.[164]

The **marginal willingness to pay (MWTP)** was identified as the marginal value of an additional kilogram of fish, or an additional fish. The MWTP was calculated using regression analysis to identify the reasons for fishing beyond those of catching fish (based on survey information), and only included anglers who caught fish. The MWTP could provide useful information for policy purposes such as fishery allocation and cost-benefit analysis.

The **average willingness to pay (AWTP)** was calculated by multiplying the mean WTP of all anglers, including those who didn't catch fish, by the total kilograms of fish caught and kept.[165] The inclusion of all anglers means that this figure provides an estimate of the value of recreational fishing across all species surveyed in New Zealand.

9.3.2 The choice of the correct value for the total economic valuation

This difference is very relevant in the context of this study, as the goal is not to assess the impact of a policy change (for which the marginal willingness to pay would be the correct value to use), but to assess the value of recreational fishing in the Hauraki Gulf using the total economic value framework and therefore capturing not just the use value of the fish but all the values related to the recreational fishing experience. As explained by Lindsay et al. (1999, pp. ii–iii):

> *Fishers in the recreational sector may harvest the resource for a variety of reasons. Such reasons may include: informal food supplementation; for sport where fishers may go to elaborate means to meet the challenge; a quiet recreational pursuit; or to enjoy the outdoors. People also fish for spiritual and cultural reason. The variety of reasons indicate that valuations of the resource will differ and that the evaluation is mixed with valuations of visual amenity and social experiences and with other activities such as tourism. Just as the value of production (output) has been the most common form of misconception over the commercial economic value of fisheries, then the amount spent by recreational fishers to catch fish has also been a commonly misused concept.*
>
> *However, as commercial economic value of fish is not its gross production value (or the amount spent by commercial fishermen catching the fish), neither is the cost associated with fishing recreational economic value.*
>
> *There are two different estimates that can be used to represent the value of recreational fishing:*
>
> *(1) The value of recreational fishing as a whole, to work out what fishing is worth to New Zealand. This includes experienced anglers who are willing to spend money trying to catch fish even though they are not successful. This estimate is the value of recreational fishing as social*

[164] This estimate does not include capital expenses such as the boat and rods, nor does it include multiplier effects.

[165] The authors note that the AWTP was not the amounts people said they were WTP, but were taken from the database of survey information.

activity, and measures the value placed on the whole day. It involves the application of average willingness to pay (AWTP) estimates.

(2) The value of recreational fish, estimates the actual value of the fish caught in order to compare the value of recreational fish to commercial fish. These values estimate the value of the additional fish caught, taking into consideration all other factors that influence the willingness to pay for the day's fishing trip (in other words, it strips out the influence of all other variables on willingness to pay). It involves the application of marginal willingness to pay (MWTP) estimates.

In addition to these values, there is another way of looking at the contribution of recreational fishers to the economy, namely the direct expenditure they make.'

Lindsay et al. (1999) argues that the marginal WTP values are the best illustration of how much recreational fish are worth to New Zealand recreational fishers. These are the values that are most useful for policy purposes, i.e. for cost-benefit analysis, fishery allocation, legal situations and for comparing against commercial fishing economic values.

On the other hand, Lindsay et al. (1999) affirms that if the purpose is to illustrate the general value of recreational fishing in New Zealand, then average WTP values may provide more information. Estimates of the total amount spent per year by a fisher targeting a particular species will provide a rough estimate of the amount of expenditure spent by anglers in the economy. However, it must be noted that these figures are based on recurrent expenditure only and do not take into account any capital expenditure (such as boats and rods) or multiplier effects.

In 2001, Wheeler and Damania undertook an assessment of the validity of WTP estimates, including those by Lindsay et al. (1999) of AWTP and MWTP and the use of these values for policy. Wheeler and Damania also noted that the AWTP 'captures benefits' relating to the fishing experience which may not involve actually catching fish. These benefits may include (but are not limited to) sport, recreation, enjoying the outdoors, spiritual and cultural values. Conversely the MWTP estimates the value of the fish caught:

> *When valuing recreational fishing for policy purposes, both the marginal and the average values are important. If the objective is to value recreational fishing, then either consumer surplus, or the average WTP of fish may be of use. The average WTP, which is reported in Lindsay et al. (1999), captures benefits from non-catch sources. On the other hand, if the objective is to estimate the value of recreational fish caught, the marginal WTP, which estimates the value of the additional fish caught, is the more appropriate measure. The choice of variable thus depends on the policy question.*[166]

Therefore, in the context of this research the AWTP is clearly a better indicator of the values of recreational fishing and not just the value of the marginal recreationally caught fish, which is better reflected by the MWTP.

As discussed earlier, recreational fishers are motivated to fish not just by the value of the catch, but also by a number of additional (and even alternative) reasons or values, which precisely reflect the holistic approach of the total economic value assessment.

Table 35. New Zealand recreational fishing values, 1999, $$_{2011}$$

	Value per fish kept/caught	Value on a per kilogram basis	Amount spent $$_{2011}$$

[166] Wheeler and Damania, 2001, p. 605.

	MWTP $\$_{2011}$	AWTP $\$_{2011}$	MWTP $\$_{2011}$	AWTP $\$_{2011}$	Total MWTP Value $\$_{2011}$m	Total AWTP Value $\$_{2011}$m	Per trip	Total annual expenditure $\$_{2011}$m
Snapper	7.8	41.9	7.9	42.3	21.5	115.5	48.6	566.4
Kingfish	26.8	245.8	4.4	40.5	1.7	15.5	67.4	173.9
Blue cod	2.2	33.2	3.3	49.5	2.4	36.1	59.9	154.0
Kahawai	4.7	81.0	3.8	65.8	5.8	99.9	34.4	206.9
Rock lobster	8.9	65.6	13.5	99.3	4.2	31.1	69.9	220.3
Total values	—	—			**35.5**	**298.1**	**—**	**1,321.5**

Source: Wheeler, S. & Damania, R., 2001.

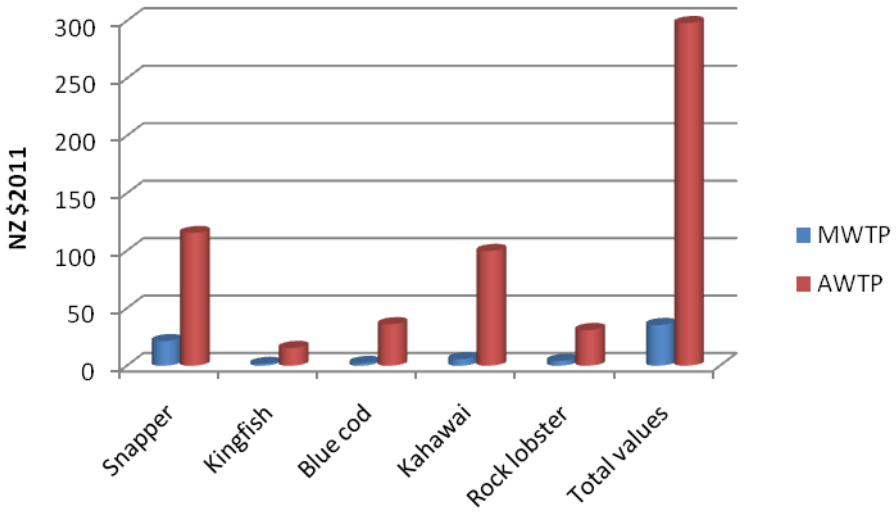
9.3.2.1 Marginal willingness to pay (MWTP)

Where the main reason for going fishing is consumption, the WTP is relatively low because of the ability to purchase fish (a close substitute to going fishing).[167] Overall, the MWTP is greater than the port (wholesale) price of commercial fish (with the exception of rock lobster), but lower than the retail price. However, the AWTP is 'significantly higher' than the retail prices for all fish species – illustrating that the activity of 'recreational fishing has far greater value than the prices consumers pay at shops'.[168]

Marginal values were calculated on a per fish and per kilogram basis. Total MWTP was $\$_{2011}$35.5 million, made up of $\$_{2011}$21.5 million for snapper, $\$_{2011}$5.8 million for kahawai, $\$_{2011}$4.2 million for rock lobster, $\$_{2011}$2.4 million for blue cod, and $\$_{2011}$1.7 million for kingfish.

Figure 21. Total value of recreational fishing by specie expressed in terms of marginal and average willingness to pay (MWTP & AWTP), 2006, NZ$\$_{2011}$

[167] Wheeler & Damania, 2001.
[168] Lindsay et al., 1999, p. 91.



Source: Wheeler, S. & Damania, R., 2001.

9.3.2.2 Average willingness to pay (AWTP)

AWTP for fish species targeted were estimated for recreational fishing on both a per kilogram and a per fish basis. On a per kilogram basis, the total AWTP for snapper was $85.1 million. kahawai was the second highest at $73.6 million, followed by rock lobster ($22.9 million), blue cod ($26.6 million) and kingfish ($11.4 million). The total AWTP for the five species was estimated to $219.6 million. On a per fish basis, the AWTP for kingfish was highest, at $181.10 per trip, followed by kahawai ($59.65); rock lobster ($48.29); snapper ($30.85) and blue cod ($24.46).[169] Table 35 updates these values to $\$_{2011}$.[170]

9.3.2.3 Total Annual Expenditure

Both MWTP and AWTP are good indicators for the economic value of fish and fishing trips, which includes the benefits to fishers above and beyond the costs of the activity. However, they are not necessarily useful for providing robust figures on the contribution of recreational fishing to GDP or GRP.

GDP and GRP measure the monetary economy; therefore knowledge on the actual expenditure of fishers is required so that flow-on effects in the wider economy can be established. Lindsay et al. (1999) have collected information on costs of consumables, but caution against relying on these figures for reasons including double counting.

The value of the recreational fishery differs depending on the fish species targeted. The largest total recurrent expenditure in a given year was for snapper fishing, at $\$_{2011}$566 million, followed by rock lobster fishing ($\$_{2011}$220 million), kahawai ($\$_{2011}$206 million), kingfish ($\$_{2011}$173 million) and blue cod

[169] Lindsay et al., 1999.
[170] These figures have been updated to 2011 using the GDP deflator.

($_{2011}$154 million). The total annual recreational fishing expenditure in New Zealand was estimated to be $_{2011}$1,321 million.[171]

> *Fisher expenditures, whilst a cost to fishers, can be of benefit to others, particularly those who supply goods and services to fishers. The full expenditure itself is not a measure of value, but the profits it generates for suppliers (and their suppliers), measured as value added is of relevance*.[172]

9.3.2.4 Projections

No formal projections have been made regarding the value of the New Zealand recreational fishery. However, Lindsay et al. (1999) recorded some interesting socio-economic characteristics of fishers based on their survey. Recreational fishers tended to be older: 31% of recreational fishers were aged 41–50 years; 29% aged 31–40 yrs, and only 15% aged 21–30 yrs. Income levels and employment type and status were also relevant. Awareness of the importance of these factors may be useful in projecting future demands and potential issues. Indications are that the demographic make-up of populations close to the Hauraki Gulf Marine Park will be important to future recreational demands on this fishery, along with population size and growth.

9.4 A Tentative Valuation

Commercial and recreational fishing catches, expressed in tonnes, in New Zealand and in the Hauraki Gulf are shown in

Table 36.

The species available in the Hauraki Gulf Marine Park influence the value of recreational fishing in that region. For example, there are relatively large values associated with kingfish and rock lobster (on a per fish basis). Interestingly, on a per kilogram basis, the kingfish value is relatively low. Wheeler and Damania (2001) contend that this is because the value is in the fishing experience, rather than in the fish value. Similarly, some fishers value kahawai because of the fishing experience – for this fish, the value to fish was greater than the retail cost of the fish.[173]

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[171] The authors urge caution with the figure for amount spent may involve some double counting with expenditure of various fishers, and note that the population of fishers used to calculate the values was 'highly questionable'.

[172] Kerr and Latham (2011) were assessing whether benefit transfer could be utilised to estimate the consumer surplus for recreational fishing in New Zealand. Consumer surplus consists of the values over and above the expenditure on the trip (the latter contributing to GDP). Their findings were that there were few studies of the benefits, and those carried out were diverse in terms of methodology, geography and time. This produced a broad range of estimates, and the potential for achieving an accurate assessment for the New Zealand recreational marine fishery was 'extremely slim'.

[173] Wheeler & Damania, 2001.

Table 36. New Zealand and Hauraki Gulf Marine Park, commercial and recreational fishing catch

	New Zealand Recreational Catch 1999 (1)	Hauraki Gulf Marine Park Commercial Catch 2011 (2)	Hauraki Gulf(*) Recreational Catch 2011 (2)
	Tonnes	Tonnes	Tonnes
Snapper	2731	2276	1345
Kingfish	380	n.a.	n.a.
Blue cod	729	n.a.	n.a.
Kahawai	1518	345	n.a.
Rock lobster	313	n.a.	n.a.

Note: (*) Inside the area comprised by Cape Colville and Cape Rodney.

Sources:
1. Wheeler, S. & Damania, R., 2001.
2. Ministry of Fisheries, 2011.

Starting from this data, the following procedure has been adopted to attain a preliminary estimation of the recreational value of fishing in the Hauraki Gulf.

First of all, only the values for snapper and kahawai are comparable, although national recreational values were estimated in 1999 and commercial values for the Hauraki Gulf in 2011.

The following factors were also taken into account:

- New Zealand's population has increased by 13.5% between 2001 and 2011.
- Auckland's population was 31.4% of total New Zealand population in 2001 and 33.7% in 2011, therefore increasing by 22% in number and 2.3% in share.[174]
- Thames, Coromandel and the Hauraki districts account for approximately 1% of total New Zealand population.
- The Hauraki Gulf population, being surrounded by the sea, is probably more likely to be involved in recreational fishing than the average New Zealand population.
- Technological developments have increased the catch rate of recreational fishers.

It is reasonable to assume that recreational values should be recalculated by:

- increasing the total catch by the same rate of population growth, and
- apportioning to the Hauraki Gulf a share of the national catch that corresponds to the combined share (35%) of Auckland's and Waikato's Hauraki Gulf districts.

Therefore, values in

Table 36 should be recalculated as shown by Table 37.

[174] Statistics New Zealand.

Table 37. New Zealand and Hauraki Gulf Marine Park, adjusted commercial and recreational fishing catch

	New Zealand Recreational Catch 2011 Adjusted (*) (1)	HGMP Commercial Catch 2011 (2)	HG(**) Recreational Catch 2011 (2)	HG Share of Total Adjusted Recreational Catch (***) 2011 (2)
Species	**Tonnes**	**Tonnes**	**Tonnes**	**Tonnes**
Snapper	3099	2276	1345	1085
Kingfish	432			151
Blue cod	828			290
Kahawai	1723	345		603
Rock lobster	355			124

Notes: (*) 1999 value increased by 13.5%.
(**) Inside the area comprised by Cape Colville and Cape Rodney.
(***) Calculated as 35% of the adjusted national catch.

Sources: 1. Wheeler, S. & Damania, R., 2001.
2. Ministry of Fisheries, 2011.

It should be noted that the snapper catch weight (1085 ton) estimated using this assumption is 20% lower than the catch (1345 ton) estimated by the Ministry of Fishery (2011).

If we then apportion 35% of the total national value to the Hauraki Gulf, we obtain the results shown in Table 38.

Table 38. Hauraki Gulf, adjusted MWTP, AWTP and total annual expenditure recreational fishing values, $\$_{2011}$m

Species	Total MWTP Value $\$_{2011}$m	Total AWTP Value $\$_{2011}$m	Total annual expenditure $\$_{2011}$m
Snapper	7.5	40.4	198.2
Kingfish	0.6	5.4	60.9
Blue cod	(0.8)	(12.6)	(53.9)
Kahawai	2.0	35.0	72.4
Rock lobster	(1.5)	(10.9)	(77.1)
Total values	**10.1**	**80.8**	**331.5**

Source: adapted from Wheeler, S. & Damania, R., 2001.

As it is not clear the proportion of the national recreational catch of blue cod and rock lobster that could be apportioned to the Hauraki Gulf, we have decided to exclude them from the calculation. Instead, we have included kahawai and king fish, that not only are more likely to reflect the reality, but also compensate for the total elimination of the other two species.

These calculations show the values of recreational fishing in the Hauraki Gulf:

- the total marginal willingness to pay (MWTP) is $\$_{2011}$10.1 million
- the total average willingness to pay (AWTP) is $\$_{2011}$80.8 million, and
- the total annual expenditure is $\$_{2011}$331.5 million.

Updated research would be useful to determine the value for recreational fishing in the regional economy given the length of time since currently available data was collected, its lack of geographic specificity, and the changing demographic nature of Auckland. This would include information on expenditure by fishers to provide regional values and more robust figures. [175]

9.5 Comparison between the Valuation of Recreational and Commercial Fishing

In this section, we will provide a comparison between the tentatively assessed values of recreational and commercial fishing. As discussed in previous paragraphs, in order to assess the value of recreational fishing the average willingness to pay (AWTP) is commonly considered the most accurate value. However, we will also compare the marginal willingness to pay (MWTP). As for commercial fishing we will use the gross value of catch for commercial fishing, as calculated before.

Although these values provide useful insights, they have to be treated with extreme caution and are not significant from a strict economic perspective.[176] Main concerns relate to the fact that these values:

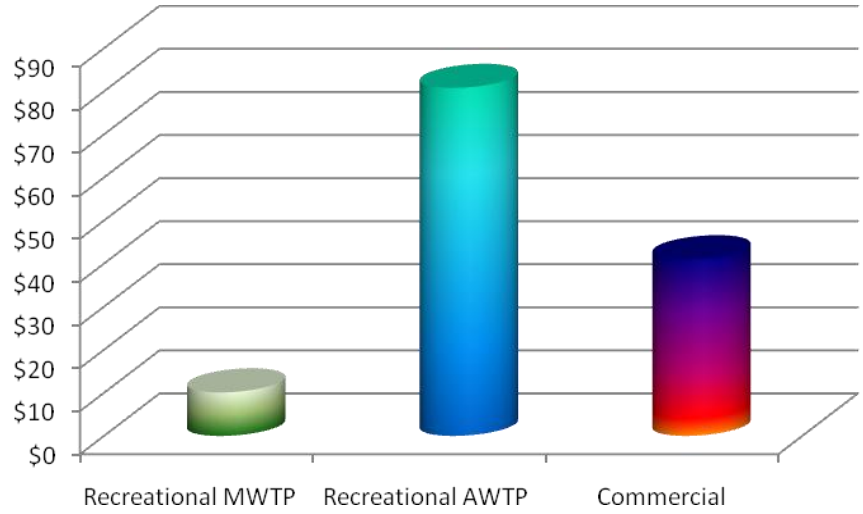
- are not homogeneous market values
- were obtained by applying a number of difficult to verify assumptions and to different sets of data
- were not obtained through an acceptable economic impact assessment methodology (e.g. commercial fishing does not include any economic impact assessment that considers the wider impact of that activity on the economy, i.e. indirect and induced impacts), and
- were estimated using different methodologies and a number of assumptions (e.g. the value of recreational fishing is able to capture a wider spectrum of values not just related to the use value of the catch).

Despite these concerns, we still consider it worthwhile to compare those valuations. Figure 22 shows the two alternative valuations of recreational fishing (MWTP $10.1 million and AWTP $80.8 million) beside the commercial one ($41 million).

[175] The Ministry of Primary Industries is currently undertaking a “large scale, multi-species’ (LSMS) survey, a multi-year research project that is examining the species, harvest, and distribution of recreational fisheries across New Zealand. Whilst the results of this research will not be available until next year, it may be able to assist with recreational fishing valuations and assessment in the future.

[176] A review of the Lindsay et al. (1999) study notes that: ‘Consumer surplus is two to four times expenditure, indicating that value added from recreational fishing is likely to be very small in comparison to consumers’ surplus’ (Kerr & Latham, 2011, p. 5).

Figure 22. Recreational and commercial fishing total estimated values in the Hauraki Gulf



Source: elaboration on Wheeler, S. & Damania, R., 2001; Ministry of Fisheries, 2011; Boyd, 2012.

Due to data availability, it is only possible to directly compare values for the snapper and the kahawai. [177] Table 39 illustrates both the commercial and recreational values. Of course, the result is very different if we use the MWTP or the AWT. While the MWTP of recreational fishing is just 50% of the value of the commercial gross value of catch for these two species; the total recreational AWTP is four times bigger than the total commercial value.

Table 39. Recreational and commercial fishing catch and values of selected species in the Hauraki Gulf

Species	Recreational Catch	Recreational MWTP	Recreational AWTP	Commercial Catch	Domestic Value (10%)	Commercial Export Value (90%)	Commercial Total Value
	Ton	$\$_{2011}$m	$\$_{2011}$m	Ton	$\$_{2011}$m	$\$_{2011}$m	$\$_{2011}$m
Snapper	1085	7.5	40.4	2276	2.8	21.3	24.1
Kahawai	603	2.0	35.0	345	0.04	0.3	0.3
Total		**9.6**	**75.4**		**2.8**	**21.6**	**24.4**

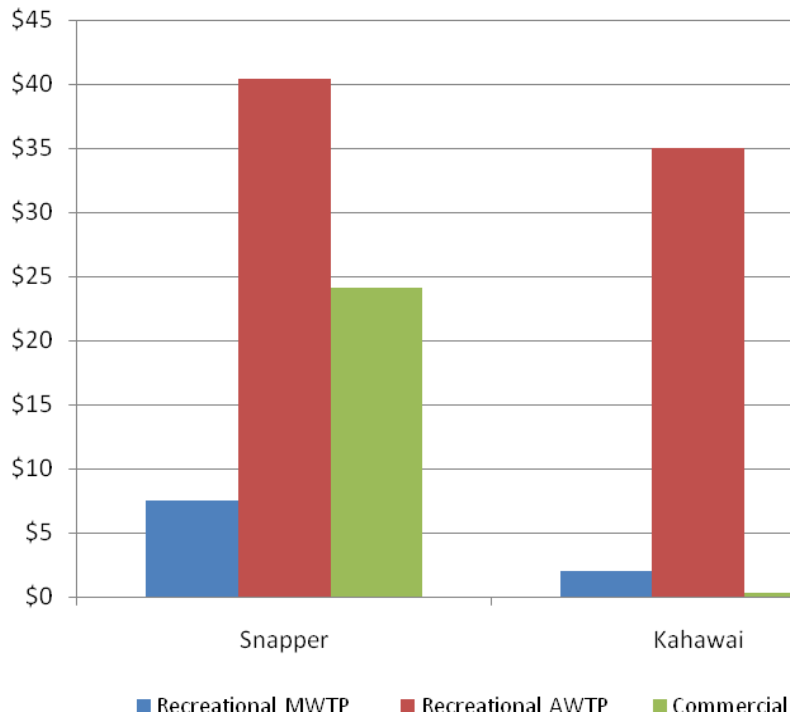
Source: elaboration on Wheeler, S. & Damania, R., 2001; Ministry of Fisheries, 2011; Boyd, 2012.

However, the difference in value is particularly significant with respect to kahawai: $35 million recreational versus $0.3 million commercial (see Figure 23). If only the snapper value is observed, the value of the commercial gross value of the catch is equivalent to 60% of the snapper recreational

[177] It is useful to remember that snapper represents more than 70% of the land value and 60% of the export value. This comparison is significant , as Boyd (2012, p. 11) points out: ' Although there is a diverse range of fishing methods used and species taken in the commercial fishery within HGMP, snapper is by far the most valuable species. The inshore fishing industry relies on snapper for its existence. Without the income generated from the snapper fishery, commercial trawling, Danish seining and long-lining in the HGMP area would not be commercially viable. In recent years, approximately 50% of the total commercial catch of snapper from the SNA1 stock has come from the HGMP area.'

fishing AWTP, a value that does not seem to overestimate the relative contribution to the local economy of both activities.

Figure 23 Comparison of recreational (MWTP & AWTP) and commercial values of snapper and kahawai



10. Tourism and the Hauraki Gulf

10.1 Introduction

Tourism plays a significant role in the New Zealand economy: it produces both goods and services, generates foreign currency (export earnings), and creates employment opportunities.

The Hauraki Gulf has an important role to play in tourism, with the region's natural environment – both landscape and coastal – being considered to be its greatest collective asset. The diversity of outdoor activities within the region offers opportunities to visitors, with vast tracts of public space and parks to explore bush, farmland, beaches, volcanic fields and waterways.

In the year ended January 2012, more than 2.6 million international tourists visited New Zealand. The largest numbers came from Australia (44%), followed by the United Kingdom (9%), the United States (7%), China (6%) and Japan (5%). More than half (53%) were on holiday, while the rest stated that the purpose of their visit was to visit friends or relatives (37%), or for business (11%). Their total expenditure was $5.763 billion.

Domestic tourist flows accounted for 48 million trips and 49 million nights.

The Ministry of Tourism (2012) calculated that tourist expenditure totalled $23 billion, of which $9.7 billion (42%) came from international tourists and $13.2 billion (58%) from domestic tourists. This expenditure contributed $6.9 billion of direct value added, or 3.8% of total New Zealand GDP, and the employment generated by tourism was 92,000 FTEs or 4.8% of total employment.[178] Foreign tourist expenditure accounted for 16.8% of New Zealand's total export earnings.

Tourism expenditure includes spending by all travellers, whether they are international or domestic, recreational, business or government travellers. In 2008, 18% of all tourists visited Auckland, and tourism comprised $2 billion or 4.3% of Auckland's GDP.[179] Tourism is even more important to the economy in the Coromandel region.

A quarter of the tourists travelling through New Zealand and Auckland take part in nature-based activities. The 'nature tourism' segment of the tourism industry is a valuable contributor to the Auckland and Coromandel economies, and its size is expected to grow in future.[180] Auckland's amenities and facilities are the main reason why holiday tourists visit and stay in Auckland. The Hauraki Gulf and its islands are not usually mentioned separately as a specific major attractor, but the coastal environment is one of the main drivers of tourism. For the Coromandel region, tourism – and in particular nature tourism – is even more important, and is crucially dependent on the attractiveness of the coastal environment.

As the nature tourism industry grows, there will be increasing pressure on receiving facilities and amenities of all kinds, including local tourist transport, accommodation, excursions and airport connections. Similarly, improved amenities, facilities and environmental quality can only enhance the region's attractiveness to tourists.

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[178] Statistics New Zealand, 2011, Tourism Satellite Account.
[179] In 2011. Infometrics, 2012.
[180] Nature-based tourism is defined by Statistics New Zealand as a visit (from outside the respective region) that includes participation in at least one nature-based activity.

10.2 Hauraki Gulf-Related Tourism Flows: Proxy and Definitions

No specific study has been undertaken of the economic contribution of the portion of tourist flows to the Hauraki Gulf area that is directly related to the Hauraki Gulf itself, and so we must instead rely on proxies.

As this study is about assessing the total economic value of the Hauraki Gulf, we will focus on tourism's economic impacts in Auckland and the Coromandel.

10.2.1 Nature-based tourism as a proxy

In order to identify a suitable proxy for the economic impact of the Hauraki Gulf-related tourism flows, probably the best starting point is Auckland's plus Coromandel's 'nature-based tourism', which is defined as a visit from outside the respective region that includes participation in at least one nature-based activity.[181] Nature-based activities are further defined as 'outdoor activities undertaken by tourists in the natural environment'. This also includes non-coastal activities such as lakes and hot pools that do not directly involve the Hauraki Gulf, but it seems unlikely that many nature holiday tourists in Auckland or Coromandel would prioritise these outdoor activities exclusively, without also participating in activities with a beach, coastal, marine or sea-view component. In fact, the top three nature-based activities for international visitors to Auckland are beaches, scenic drives and cruises, all of which have a clear link to the Hauraki Gulf.[182]

10.2.2 Tourism definitions[183]

Tourism: measured by trips (i.e. visits) – a given individual may visit more than once, counting as multiple trips. A trip could be for any purpose including business or education and would still be included as tourism.

Domestic tourism: includes only trips from one region of New Zealand to another; excludes trips within a region; includes both day trips and overnight stays.

Nature-based tourism: defined as 'international and domestic visitors, aged 15 years and over, who participate in at least one nature-based activity while travelling in New Zealand'. 'Local residents participating in nature-based activities within their area are not included in this definition'[184].

Nature-based activities: defined as 'outdoor activities undertaken by tourists in the natural environment'.[185]

Propensity: the proportion of tourism that is nature-based.

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[181] But does include Coromandel residents visiting Auckland, and vice versa.

[182] Ministry of Tourism, 2009. Allocating all Auckland's nature-based tourists to the Hauraki Gulf is clearly an overestimation, because there are other natural attractions. However, this risk is compensated by the fact that recreational activities performed in the Gulf by Auckland residents are not accounted for and that also non-nature-based tourists (the vast majority of international tourist visiting Auckland) are attracted by the Gulf (e.g. visiting relatives, wine tasting in Waiheke) but their spent is not accounted for either. This risk of overestimation is further discussed later in this section.

[183] Ministry of Tourism, 2009.

[184] Quoted from Ministry of Tourism, 2009

[185] Ministry of Tourism, 2009.Tourism Sector Profile/Tourist Activity/Nature-Based Tourism

10.3 Nature Tourism in New Zealand, Auckland and the Coromandel

10.3.1 New Zealand's domestic and international tourists

Tourist flows are divided into domestic visitors and international visitors, depending on whether the tourist lives in New Zealand or overseas. It is important to separate these two different types of visitors because their respective spend patterns and propensities to engage in nature tourism can be quite different (see Table 40). For New Zealand as a whole, the majority (70%) of international visitors engage in nature-based activities, whereas only 22% of domestic trips are nature-based.[186,187] However, the much greater number of domestic trips in total (44 million domestic compared with 2.3 million international) means domestic nature tourism trips (9.6 million) greatly outnumber international nature based trips (1.6 million).

Table 40. New Zealand tourism breakdown, 2008

	Domestic	Domestic %	International	International %	Total	Total %
Nature	9,600,000	22%	1,600,000	70%	11,200,000	24%
Non-nature	34,400,000	78%	700,000	30%	35,100,000	76%
Total trips	44,000,000	100%	2,300,000	100%	46,300,000	100%

Source: Ministry of Tourism, 2009.

10.3.1.1 Trip purpose – international tourists

Nearly all international holiday tourists participate in nature-based activities (92% in 2008; see Table 41). Consequently this group makes up the majority of international nature-based tourists (64% in 2008). International tourists visiting friends or relatives make up the second largest group (25%), but their overall propensity to participate in nature-based activities is lower (59%). The remaining 11% of international nature-based tourists are visiting New Zealand for business, education or other purposes. The most popular areas visited by international nature-based tourists in 2008 were Rotorua (563,400 tourists, or 36% of all international nature-based tourists), Auckland (541,700, 35%) and Fiordland (453,700, 29%)[188]. For international visitors the most popular nature-based activities in Regional Tourism Organisations (RTOs) include - Auckland and Northland (beaches, scenic drives and cruises), Rotorua (geothermal), Waikato (glow worm caves), Nelson (beaches and trekking), Canterbury (beaches and whale watch), West Coast (glaciers), Queenstown (jet boating) and Fiordland (scenic boat cruise). Ninety seven percent of international tourists to Fiordland RTO participated in a nature-based activity. This is the highest propensity for visitors to an RTO. This was followed by the West Coast (91%), Rotorua (87%) and Ruapehu (86%). International tourists to Auckland RTO had a low propensity (31%) to participate in nature-based activities[189].

[186] Domestic trips are only those trips from one region of New Zealand to another; excludes trips within a region.
[187] The number of visitors is measured by the number of trips. If a given individual visits more than once, then this is counted as multiple trips.
[188] Ministry of Tourism, 2009
[189] Ministry of Tourism, 2009.

10.3.1.2 Trip purpose – domestic tourists

Domestic nature-based tourists are also predominantly on holiday (63%), while a significant number are visiting friends or relatives (25%). Again, tourists on holiday have the highest propensity to undertake nature-based activities (34%), followed by those visiting friends and relatives (17%). These domestic propensities are much lower than for international tourists.

Table 41. Nature tourists: trip purpose and propensity, 2008

	International Visitors		Domestic Visitors	
	Purpose	**Propensity**	**Purpose**	**Propensity**
Holiday	64%	92%	63%	34%
Visit friends or relatives	25%	59%	25%	17%
Business/education/other	11%	36%	12%	10%
Total or average all purposes	100%	70%	100%	22%

Source: Ministry of Tourism, 2009.

10.3.2 Auckland's domestic and international tourists

Auckland has the country's highest number of nature-based tourists: in 2008, 1.9 million nature tourists visited Auckland (17% of the national total), while the region with the next highest number was Northland with 1.2 million nature visitors.[190] Auckland has a relatively high proportion of international nature tourists compared with domestic ones: 0.54 million international nature tourists compared with 1.38 million domestic.

Auckland is a major international destination (and gateway), but not surprisingly the main trip purpose is not nature tourism (see Table 42): only 31% of international visitors to Auckland engage in nature tourism, which is much lower than for other destinations in New Zealand. However, Auckland's share of the country's international visitors of all types is so high (76%) that the smaller share being nature tourists still gives Auckland a 34% share of all international nature tourists who visit New Zealand.[191]

Domestic trip purposes, instead, are very similar to the national average and are even less nature-oriented (see Table 42). Auckland's share of the nation's domestic nature tourism is only 14%, similar to its relatively low share of the nation's domestic tourism of all kinds (15%). This is because the propensity of domestic tourists visiting Auckland to engage in nature-based activities (21%) is similar to the national average for domestic tourists (22%).

Table 42. Auckland tourism flows, 2008

	International		Domestic		
	Numbers	**Propensity**	**Numbers**	**Propensity**	**Total**

[190] Ministry of Tourism, 2009.

[191] A complicating factor is that an international visit to New Zealand can include multiple destinations, only one of which need include a nature-based-activity for the New Zealand visit to be considered 'nature-tourism'; the visit would count as 'non-nature based' for the other destinations, which would therefore sum to more than the national total of non-nature-based tourism.

Nature	542,000	31%	1,381,000	21%	1,923,000
Non-nature	1,206,387	69%	5,324,748	79%	6,531,135
Total Tourism	1,748,387	100%	6,705,748	100%	8,454,135

Source: Ministry of Tourism, 2009, and Auckland Council elaboration.

10.3.3 Coromandel's domestic and international tourists

Coromandel, like most New Zealand tourism destinations, is mainly a nature destination, especially for international tourists who are slightly more likely (80%) to be nature tourists, compared with the average for New Zealand destinations as a whole (70%).

In 2008 Coromandel received 9% of both domestic (0.86 million) and international (0.14 million) nature trips in New Zealand, a total of 1.0 million nature trips (see Table 43). This makes Coromandel the fifth most popular nature destination and very close behind Canterbury and Rotorua (which both had 1.03 million nature trips in 2008).

Table 43. Coromandel: domestic and international nature trips, 2008

	Auckland	**Auckland %**	**Coromandel**	**Coromandel %**	**New Zealand**	**New Zealand %**
International nature	542,000	28%	141,000	14%	1,600,000	14%
Domestic nature	1,380,000	72%	859,000	86%	9,600,000	86%
Total nature	1,922,000	100%	1,000,000	100%	11,200,000	100%

Source: Ministry of Tourism, 2009.

10.3.4 Summing up: Hauraki Gulf domestic and international tourists

In 2008, Auckland had 1.38 million domestic nature-based visits, while Coromandel had 0.86 million – a total of 2.2 million domestic nature-based visits to the Hauraki Gulf area (see

Table 44). In addition, Auckland had 0.54 million and Coromandel 0.14 million international nature-based visitors – a total of 0.7 million international nature-based visitors to the Hauraki Gulf area. Total nature-based tourism in the Hauraki Gulf area in 2008 was therefore 2.9 million trips.

The Hauraki Gulf area (Auckland plus Coromandel) represents 43% of the country's international nature-tourist trips, and 23% of domestic nature trips. This gives the Hauraki Gulf area an overall average of 26% of the country's total nature-tourism trips, with Auckland comprising 17% of the national total and Coromandel 9%.

Table 44. Regional shares of nation's nature trips, 2008

	International nature		Domestic nature		Total nature	
Auckland	542,000	34%	1,380,000	14%	1,922,000	17%
Coromandel	141,000	9%	859,000	9%	1,000,000	9%
Total Hauraki Gulf	**683,000**	**43%**	**2,239,000**	**23%**	**2,922,000**	**26%**
Rest of New Zealand	917,000	57%	7,361,000	77%	8,278,000	74%
Total New Zealand	**1,600,000**	**100%**	**9,600,000**	**100%**	**11,200,000**	**100%**

Source: Ministry of Tourism, 2009.

When nature-based trips to the Hauraki Gulf are compared to total tourist trips in New Zealand (including both nature and non-nature-based), they represent 30% of total international trips, 5% of total domestic trips, and 6% of total tourist trips (domestic plus international).

From these figures, we can observe that the Hauraki Gulf is already a relevant nature destination for international tourists but, apparently, a much less significant attractor for domestic tourists. However, the relatively low proportion of domestic trips to the Hauraki Gulf is significantly affected by the fact that more than 37% of the New Zealand population already resides in Auckland or the Coromandel, and therefore do not have to travel – and be counted as tourists – in order to enjoy the Gulf. Furthermore, the recreational and cultural benefits that Auckland residents receive from the Hauraki Gulf are significant. From a distributional perspective, the fact that low-income residents enjoy proximity and guaranteed public use and so can have free (or very low cost) access to the Hauraki Gulf's amenities, represents a very important but not yet accounted value provided by the Gulf. In fact, considering the low portion of their income that can be used for recreational activities, travel costs could represent an insurmountable barrier to their capacity to enjoy the Hauraki Gulf.

10.4 Methodology to assess the economic impact

In order to assess the economic impact of the Hauraki Gulf-related tourism flows we propose a methodology – with a variant – based on spend per trip.

We have also tested/estimated the amount spent by nature-based international tourists in Auckland.[192] The expenditure assessed by this methodology was compared with the value obtained simply by applying the share of international nature-based tourists to the total expenditure of international tourists in Auckland, as assessed by Covec (2009). This was done with the aim of providing a useful term of reference.

10.4.1 Total expenditure

The methodology is based on spend per trip and numbers of trips, taking into consideration that:

1. In section 10.3 we have identified total nature-based trips to the Hauraki Gulf, as per

[192] That is the amount spent by nature-based international tourists in Auckland. This decision was determined by data-availability constraints.

Table 44:

- international (variable **a1**) and
- domestic (variable **a2**).

2. The trip spend of international tourists can be calculated by using the average spend per trip provided by the Ministry of Tourism. As this refers to their total spent in New Zealand, we apportion only a third (33%) of their spend to Auckland or the Coromandel There are two different possibilities:

- the amount provided by the Ministry of Tourism (2009) research, which calculated a $\$_{2008}3040$ ($\$_{2011}3258$) international nature-based tourists average spend per trip in 2008, whose 33% is $\$_{2011}1,075$(variable **b1**), or

- the average expenditure per international tourist person per trip in 2011 derived from the Ministry of Tourism (2012),[193] which is $\$_{2011}2420$, whose 33% is $\$_{2011}799$ (variable **b2**).[194]

The Ministry of Economic Tourism (2012) also provides a figure of $\$_{2011}195$ per average (both day and overnight) domestic trip (variable **c**).[195]

Therefore, the gross expenditure of nature-based tourists in the Hauraki Gulf ($EXP_{NatTour}$ HG) can be calculated in two alternative ways depending on how international spend is accounted for:

$EXP_{NatTour}$ HG_1 = a1 x b1 + a2 x c

OR

$EXP_{NatTour}$ HG_2 = a1 x b2 + a2 x c

This would result, alternatively, in:

(1) $\mathbf{EXP_{NatTour}HG_1}$ = 683,000 x $\$_{2011}1,075$ + 2,239,000 x $\$_{2011}195$

= $\$_{2011}734,225,000$ + $\$_{2011}436,605,000$

= **$\$_{2011}1,170,830,000$**

of which, **$\$_{2011}$**890m (76%) is generated in Auckland and **$\$_{2011}$**281m (24%) in the Coromandel.

OR

(2) $\mathbf{EXP_{NatTour}HG_2}$ = 683,000 x $\$_{2011}799$ + 2,239,000 x $\$_{2011}195$

= $\$_{2011}545,717,000$ + $\$_{2011}436,605,000$

= **$\$_{2011}982,322,000$**

of which, $\$_{2011}$746m is generated in Auckland and $\$_{2011}$236m in the Coromandel.

[193] Both nature and non-nature-based trips.
[194] International Visitor Survey.
[195] Domestic Travel Survey.

10.4.2 Comparison with expenditure share in Auckland

Covec (2009) estimated that in 2006 the total expenditure of all visitors to Auckland was $\$_{2006}3.745$ billion, i.e. $\$_{2011}4.320$ billion, of which 67% or $\$_{2011}2.907$ billion was attributed to international visitors.[196]

So, we could also calculate spend of international nature-based visitors to Auckland by applying their share (31%, as per Table 42) to the above total spend of international visitors.

This would result in the following value:

EXP HG NatTourAKL share = $\$_{2011}2.907$ billion x 31% = **$\$_{2011}$901 million**

Let's now calculate the corresponding values obtained by using our methodology and its variant[197]:

$EXP_{1NatTour}\ HG_{AKL\ trip}$= 542,000 x $\$_{2011}1,075$ = **$\$_{2011}$583 million**

$EXP_{2NatTour}\ HG_{AKL\ trip}$= 542,000 x $\$_{2011}799$ = **$\$_{2011}$433 million**

Then we compare the two alternative results with this reference:

$EXP_{1NatTour}\ HG_{AKL\ trip}$ /EXP $HG_{NatTourAKL\ share}$ = 583/ 901 = 65%

$EXP_{2NatTour}\ HG_{AKL\ trip}$ / EXP $HG_{NatTourAKL\ share}$ = 433/ 901 = 48%

We observe in both cases a large discrepancy relative to the comparator, clearly indicating a high risk of underestimation of nature-based tourism impacts as calculated by our methodology – which crucially depends on the allocation of the Ministry of Tourism spend estimates to nature-based tourists numbers.

Further, the spend of nature-based visitors, estimated by the Ministry of Tourism (2009) is on average 13% higher than general visitors and this is not reflected in our calculation. Considering that the share of only-transiting international visitors to Auckland is, for obvious reasons, significantly higher than the national one, it seems reasonable to assume that spend of international nature-based tourists in Auckland is even higher than in the rest of the country.

Despite, this risk of underestimation we consider that, given the values assessed for tourism are already so much higher than those of any other economic activity, there is no need to stress further the importance of recreational activities in the economics of the Hauraki Gulf.

The differences between the two results, especially when the second variant is applied, are striking and therefore we advise treating this assessment with great caution.

[196] Including all kinds of visitors, that is nature and non nature-based.
[197] Only for Auckland.

10.4.3 GDP impact coefficient

Finally, the net GDP impact should be calculated.

GDP impact is calculated as the value-added component of all the related activities that are stimulated by the considered total expenditures. Therefore, GDP impact is composed of direct impact plus the stimulation impact of flow-on effects arising from that direct expenditure. Flow-on effects are a combination of indirect effects on other industries (e.g. transport, warehousing) that receive a stimulus from supplying to the tourism industry, plus induced effects of additional household spending by people employed as a result of the direct and indirect effects.

Covec (2009) has calculated that the ratio of total GDP impacts (direct plus flow-on) to gross expenditure is 80% (variable **αGDP**) for tourism in Auckland. Therefore we will apply this coefficient to the previously calculated gross expenditure ($EXP_{NatTour}$ HG), both for Auckland and Coromandel, to obtain the net economic impact (GDP HG) of the Hauraki Gulf-related tourism flows.

$$GDP_{NatTour}\ HG = EXP_{NatTour}\ HG \times \alpha GDP$$

10.4.4 Assessed economic impact

Applying this formula, the net economic impact (GDP HG) of the Hauraki Gulf-related tourism flows (Auckland plus Coromandel) is calculated:

(3) GDP HG_1 = $\$_{2011}$1,170,830,000 x 0.8 **= $\$_{2011}$936,664,000**

From this total, $\$_{2011}$656 million would be the direct impact and the remaining $\$_{2011}$281 million would be the flow-on (indirect + induced) effects.[198] Divided by region, $\$_{2011}$681 million (73%) is generated in Auckland and $\$_{2011}$255 million (27%) in the Coromandel.

Alternatively, using instead variant b2 (see section 10.4.1), the net economic impact (GDP HG) of the Hauraki Gulf-related tourism flows are:

(4) GDP HG_2 = $\$_{2011}$982,322,000 x 0.8 = **$\$_{2011}$785,857,600**

From this alternative total, $\$_{2011}$550 million would be the direct impact and the remaining $\$_{2011}$236 million would be the flow-on (indirect + induced) effects.[199]

In order to mitigate the risk of underestimation discussed before, we decided to use the total generated from equation (3), i.e. $GDP_{NatTour}\ HG_1$= $\$_{2011}$936,664,000 as the economic impact assessment of the Hauraki Gulf related tourism flows.

10.5 Employment Generation

Infometrics (2012) states that the total Auckland tourism sector employed 35,440 people in 2011 and generated a direct GDP value of $\$_{2011}$2110 million. On that basis, the ratio is 16.8 jobs per million dollars of GDP.[200]

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[198] Applying the coefficients and multipliers used by Covec, 2009.
[199] Applying the coefficients and multipliers used by Covec, 2009.

Applying the above job intensity ratio to the assessed GDP impact from equation (3), we obtain:

(5) Employment HG = 16.8 x 937 **= 15,742**

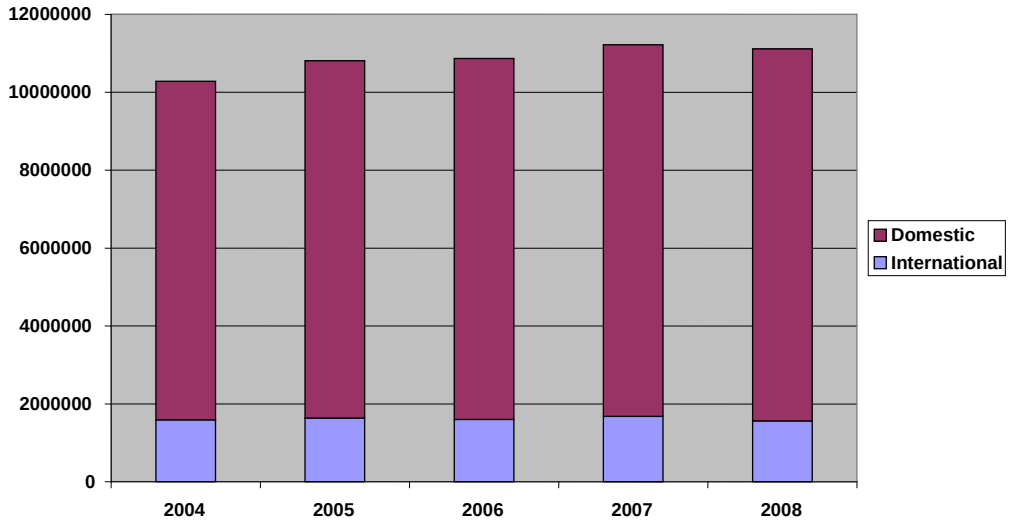
Therefore, we can estimate that the total employment impact of Hauraki Gulf-related tourism flows is approximately 15,742 jobs. By region, this would break down to 11,453 jobs generated in Auckland and 4,289 jobs in the Coromandel.

10.6 Trends and Future Projections

10.6.1 Trends in international and domestic nature-based tourists

The number of nature tourists for the country as a whole showed a slight upward trend over the four years from 2004 to 2008; this was driven mainly by an increase in the domestic component.

Figure 24 Nature-based tourists in New Zealand



Source: Ministry of Tourism, 2009.

10.6.2 Trends in propensity to engage in nature tourism

No long-term future projections are available for nature tourism as such, so instead we must use overall tourism as a proxy. The nature tourism component will grow at the same rate as tourism as a whole, provided nature tourism remains a constant proportion of total tourism. The proportion of tourism that is nature tourism is represented by the propensity of tourists to engage in nature-based activities. Aside from a small dip when the global financial crisis struck in 2008, the propensity has remained fairly constant over time, with if anything a slight upward trend for domestic tourists.

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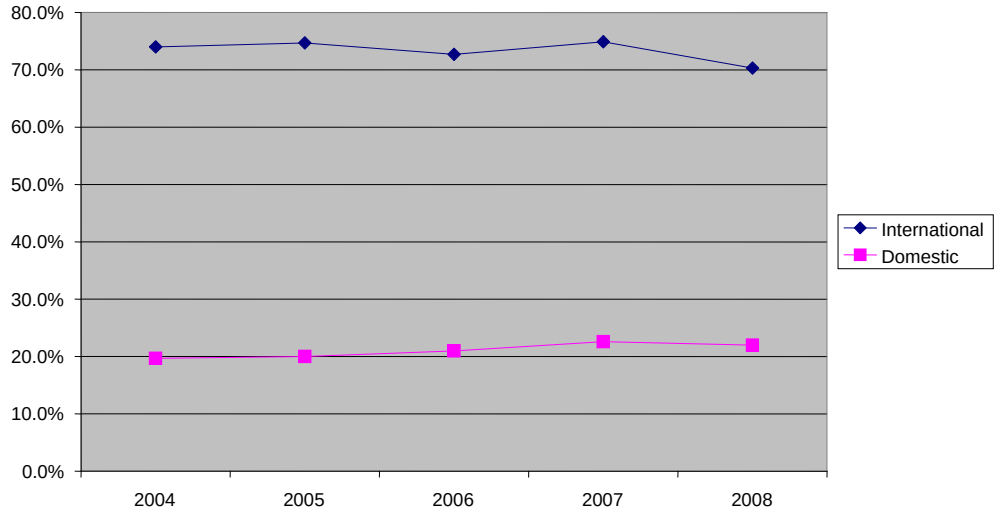
[200] Which, for want of more detail, we assume to apply to nature tourism and indirect and induced GDP as well.

Figure 25. Propensity to engage in nature-based activities



Source: Ministry of Tourism, 2009.

10.6.3 Tourism future projections

Tourism is projected to grow at a slower rate than total GDP for Auckland, so its share will decrease over time although its absolute size will still increase. Tourism industry activity in Auckland is projected to grow between 2007 and 2031 by around 1.4% to 2.0% yearly, and the 'business as usual' (medium-growth) scenario is expected to be around 1.7% yearly.[201]

10.7 Concluding Remarks

The following tables and figure summarise the result of this exercise.

As shown by

Table 45, direct GDP impacts represent the large majority (70% or $\$_{2011}$656 million) of the total GDP impact; however, the share of indirect and induced impacts ($\$_{2011}$281 million) is also very significant and generates almost a third of the total GDP impact ($\$_{2011}$937 million).

As expected, most (73% or $\$_{2011}$656 million) of the benefits from nature-based tourism flows are captured by Auckland, while those captured by Coromandel represent more than a quarter of the total ($\$_{2011}$255 million). However, when the relative population and size of the economy of the two regions is taken into account, Coromandel's share is relatively much bigger than the Auckland's. This is not so surprising, considering that the Coromandel is a very popular nature destination both for domestic and international tourists.

[201] Market Economics Limited, 2009. *Economic Futures Model.*

Employment generation from tourism is substantial, reflecting the high labour intensity of the sector. Total employment generation is 15,742 FTEs, of which 11,4 FTEs are in Auckland (76%) and almost 3,778 in the Coromandel.

Table 45. Summary of economic and employment impacts

	$_{2011}$million	**%**	**Employment (FTEs)**	**%**
HG direct GDP impact	656	70%	11,019	70%
HG indirect and induced GDP impact	281	30%	4,723	30%
HG total GDP impact	937	100%	15,742	100%
Auckland total GDP impact	681	73%	11,453	73%
Coromandel total GDP impact	255	27%	4,289	27%
Hauraki Gulf total GDP impact	937		15,742	100%

Source: Auckland Council elaboration on Covec, 2009, and Ministry of Tourism, 2009 and 2012.

Despite international tourists representing only 30% of total nature-based trips in the Hauraki Gulf, they account for almost 63% of the economic impact in the Hauraki Gulf (see

Table 46). Their relative importance is of particular significance to Auckland because they contribute 50% of the total economic impact, and their value of $_{2011}$466 million is more than double that of domestic tourists ($_{2011}$215 million). As the Coromandel is a very popular destination for many New Zealanders and, in particular Aucklanders, domestic flows (14%, or $134m) are slightly higher than international ones (see also

Figure 26).

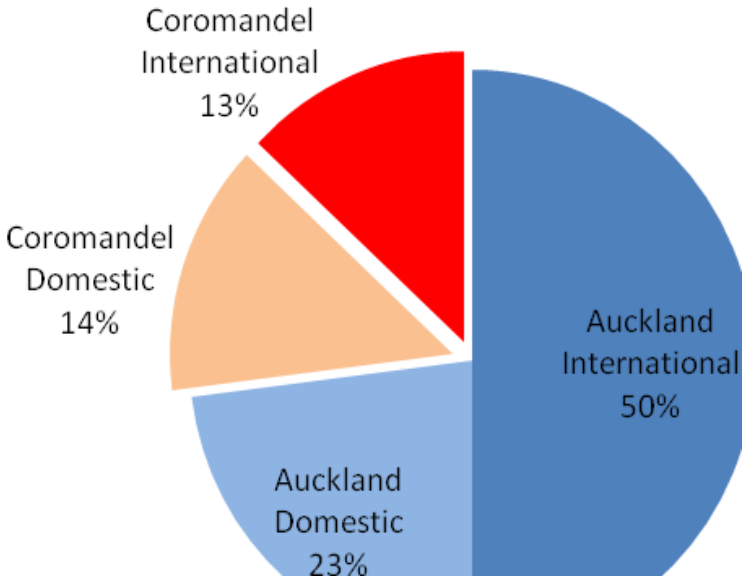
Table 46. Nature-based tourism GDP values in the Hauraki Gulf, NZ$_{2011}$ million

	International nature	**Domestic nature**	**Total nature**

Auckland	466	50%	215	23%	681	73%
Coromandel	121	13%	134	14%	255	27%
Total Hauraki Gulf	587	63%	349	37%	**936**	100%

Source: Auckland Council elaboration on Covec,2009, and Ministry of Tourism, 2009 and 2012.

Figure 26. GDP Impact of international and domestic nature-based tourists to the Hauraki Gulf



11. Events Relating to the Hauraki Gulf

11.1 Introduction

Auckland is a popular venue for national and international events, including prestigious international yachting competitions as well as a variety of smaller sailing and water sports events. Therefore, the Hauraki Gulf has a role to play in generating events related to economic activities.

Events of all kinds contributed at least $\$_{2008}$440 million to Auckland's GDP in 2008.[202] This includes the direct, indirect and induced impacts of the initial expenditure of around $480 million. However, most of these events bear no relation to the Hauraki Gulf.

The events most likely to be related to the Gulf are[203]:

- major international yachting events such as the America's Cup, the Luis Vuitton Cup and the Volvo Ocean Race (VOR) [204]
- smaller sport and recreation events relating to water and beach-based sports such as sailing, swimming, kayaking and beach volleyball, and
- general events, although the harbour contribution to general events is minimal.

[202] Covec, 2009a.

[203] Rugby World Cup 2011 (RWC) included a waterfront Fan Zone, and a harbour-side fireworks display that were enhanced by being next to the harbour, but could also have been held at a suitable venue away from the harbour. For this reason, the RWC has not been included in these calculations.

[204] The VOR does not stop in Auckland every year, so not necessarily in the 2008 reference year.

11.2 Major Yachting Events

11.2.1 America's Cup

There was $473 million of additional GDP generated by the America's Cup in 1999/2000 and a further $450 million in 2001–2003.[205] Large percentages of these impacts were generated not during the event but by super-yacht construction and activity over relatively long periods of time and therefore are captured in this study by the recreational marine industry economic contribution assessment. Hosting the America's Cup conferred significant benefits on the local marine industry through purchases of super-yachts and other marine products.

11.2.2 Louis Vuitton Cup[206]

There was $16 million of additional output generated by the Louis Vuitton Pacific Series in 2009, which created a regional GDP impact of $12 million. More than half of this impact was generated by super-yacht refits that would not have occurred in the absence of the event. The Louis Vuitton Pacific Series 2009 generated at least $9 million of business for the local marine industry, and this revenue would not have been generated in the absence of the event.

11.2.3 Volvo Ocean Race (VOR)[207]

The Volvo Ocean Race is held every three years. There have been 11 held in the 40 years since it began (in 1973), of which eight have included an Auckland stopover.[208]

The direct expenditure benefits of hosting a VOR stopover are estimated at $14.1 million for New Zealand and $15.3 million for Auckland.[209] The Auckland impact is larger than the national impact because some of the money required to deliver the event would be sourced from other parts of New Zealand and spent in the Auckland economy. This level of expenditure would generate $12–$13.4 million of additional GDP nationally, and $10.7–$12.3 million of additional GDP in Auckland. Furthermore, the media impact (advertising-equivalent value) of hosting a 16-day stopover in Auckland is estimated at $6 million.

11.2.4 Combined impact of major yachting events

The impact of major yachting events varies from year to year, but we can estimate an annual average over the next 10 years. Future major yachting events in Auckland cannot be accurately predicted, so we must rely on the following assumptions:

- America's Cup: There have been two America's Cups in Auckland in the last 20 years, so over a 10-year period, we assume one America's Cup.

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[205] Covec, 2009a.
[206] Covec, 2009b.
[207] Formerly Whitbread Around The World.
[208] http://www.volvooceanraceauckland.com/auckland.php
[209] Covec, 2009b.

- Louis Vuitton: There have been two Luis Vuitton events in the last 10 years, so we assume there will be two Luis Vuitton events in the next 10 years.
- Volvo Ocean Race: There have been eight Volvo stopovers in Auckland in the last 40 years, so we assume there will be two Volvo Ocean Race events in the next 10 years.

The combined GDP impact (annual average) for major yachting events can be estimated as around $50 million, as shown in Table 47. Nearly 90% of the impact arises from the America's Cup, 5% from Louis Vuitton, and 7% from the Volvo Ocean Race.

Table 47. Major yachting events in Auckland

	GDP per event	Events per 10 years	GDP 10 years	GDP/year
America's Cup	$450m	1	$450m	$45m
Louis Vuitton	$12m	2	$24m	$2.4m
Volvo Ocean Race	$18m	2	$36m	$3.6m
Total		**5**	**$510m**	**$51m**

11.3 Smaller Beach or Harbour-Based Events [210]

Various regional, national and international water-based sports and recreation events that directly involve the beach or harbour are held in Auckland in any given year, such as:

- sailing (smaller boats)
- kayaking
- life-saving
- swimming
- triathlon, and
- beach volleyball.

The Auckland GDP impact of water sports is not known, as its value is not available separately from other sports but instead is part of the impact of sports and recreation events, which in turn is part of the impact of all events. However, the social benefits deriving from these events are significant, although they, too, have not been quantified.

Sports and recreation events had 1.49 million attendees in 2008, which was 25.6% of total event attendances (5.82 million). We assume for simplicity that the GDP contribution is directly proportional to attendance. Events of all types contributed at least $\$_{2008}$440 million to Auckland's GDP in 2008.[211] (This includes the direct, indirect and induced impacts of the initial expenditure.) Using these figures, the sports and recreation share of total event GDP contribution is estimated as:

GDP (sports) = 25.6% x $\$_{2008}$440 million/year = $\$_{2008}$**113 million/year**

This value includes all sports, most of which have no relation to the Gulf, such as rugby, soccer, netball, tennis, cricket and hockey. In the absence of other information, we might guess that no more than one-third is water-based, i.e. around $\$_{2008}$40 million/year GDP contribution as a maximum. As no

[210] Covec, 2009a.
[211] Covec, 2009a.

more accurate information is currently available, these estimates are tentative and subject to substantial error margins.

11.4 Concluding Remarks

Based on the assumptions previously stated, events related to the Hauraki Gulf could potentially generate up to $90 million per year of GDP[212] for Auckland (including direct, indirect and induced impacts), comprising:

- $50 million/year from major international yachting events (mostly America's Cup)[213]
- $40 million/year from smaller water-based sports and recreation events[214]

The impact of events is usually considered as part of tourism; however, in the particular case of major yachting events, the super-yacht refit component (and other marine products) might be considered as being included instead in the marine industry. If we assume that half of the impact of major yachting events is tourism related and half generates income for the marine industry, then the overall split for GDP generated by events related to the Hauraki Gulf is:

- $25 million/year included in marine industry, and
- $65 million/year included in tourism.

In order to avoid double counting of the large but unknown proportion of event tourism already captured in the tourism section, we preferred not to include this valuation of the Hauraki Gulf-related events in the overall calculation. Considering that tourism and the recreational marine industry together represent more than 70% of the total tentative estimated value, the exclusion of some recreational values that are not already captured should not modify significantly the overall result.

[212] Calculated in $\$_{2008}$.
[213] Annualised average, assuming we secure multiple events over the next 10 years.
[214] Calculated estimate, with substantial error margins.

12. Marine Reserves in the Hauraki Gulf

12.1 Introduction

The Hauraki Gulf Marine Park is home to 6 of the 30 marine reserves established in New Zealand waters (see Figure 29); among them there is the first reserve (Cape Rodney–Okakari Point), established in 1975, and the last (Tāwharanui), established in September 2011. Marine reserves aim to maintain (or restore) the intrinsic biodiversity and natural processes. No fishing is permitted nor any removal of material. No dredging, dumping, construction or any other direct disturbance is allowed.

More than half of New Zealand's marine reserves are the result of external applications lodged by interest groups including tangata whenua, conservation groups, fishers, divers and marine science interest groups. Collectively, these reserves protect 7% of New Zealand's territorial sea. However, 99% of this is in two marine reserves around isolated offshore island groups (Auckland and Kermadec). Of New Zealand's total marine environment, just 0.3% is protected in marine reserves. Currently the highest level of protection outside of our territorial sea is through fisheries closures on trawling for 18 seamounts (underwater mountains). The inclusion of these closures brings the area of marine protection in New Zealand's marine environment to just over 3%.[215]

Figure 29. Marine reserves in the Hauraki Gulf Marine Park

[215] New Zealand Department of Conservation (DoC), 2011. Retrieved from: http://www.doc.govt.nz/conservation/marine-and-coastal/marine-protected-areas/marine-reserves-a-z/

Source: DoC, 2011.

Benefits provided by marine reserves relate to:

- science and education
- conservation, and
- various forms of recreation.

The six marine reserves of the Hauraki Gulf Marine Park are:

1. **Cape Rodney–Okakari Point (Goat Island) Marine Reserve**
   Cape Rodney–Okakari Point became New Zealand's first marine reserve in 1975. Within ten years snapper and crayfish populations had re-established, setting off a series of changes in the ecosystem of the reserve. Nowhere else on the coast teems with such a profusion of fish life that can easily be seen by visitors. The reserve protects 547 hectares of shore and sea spanning from Cape Rodney to Okakari Point, including the waters around Goat Island.

2. **Long Bay–Okura Marine Reserve**
   The Long Bay–Okura Marine Reserve protects a stretch of coastline on the North Shore of Auckland. The coast here is typical of that found throughout much of the Waitemata Harbour and inner Hauraki Gulf. It is moderately sheltered, and largely formed of Waitemata sandstones and mudstones. Formally established in 1995, the marine reserve includes a variety of coastal habitats: sandy beaches, rocky reefs, estuarine mudflats and mangroves.

3. **Motu Manawa Marine Reserve**
   The Motu Manawa Marine Reserve protects 500 hectares of the inner reaches of Auckland's Waitemata Harbour. It includes the intertidal mudflats, tidal channels, mangrove swamp, saltmarsh, and shellbanks surrounding Pollen and Traherne islands.

4. **Te Matuku Marine Reserve**
   Te Matuku Marine Reserve (690 hectares) protects one of Waiheke Island's largest and least disturbed estuaries and an area outside Te Matuku Bay in the Waiheke Channel.

5. **Te Whanganui-A-Hei (Cathedral Cove) Marine Reserve**
   When Te Whanganui-A-Hei (Cathedral Cove) Marine Reserve was gazetted in 1992 it became New Zealand's sixth marine reserve and the first for the Coromandel. The

reserve covers 9 square kilometres and is administered by the Department of Conservation in partnership with the Te Whanganui-A-Hei Marine Reserve Committee.

6. **Tāwharanui Marine Reserve**
   The Tāwharanui Marine Reserve came into being in September 2011. It protects an area of about 400 hectares on the northern coast of the Tawharanui Peninsula in the Rodney District, 90 kilometres from Auckland City. The marine reserve replaces the existing Tawharanui Marine Park, a no-take fishing area established in 1981. Scientific studies in the marine park have shown an increase in species such as snapper and crayfish.

12.2 The Economic Impact Assessment of the Cape Rodney–Okakari Point Marine Reserve

The Cape Rodney–Okakari (CROP) Marine Reserve was established in 1975 and was the first marine reserve in New Zealand. There is easily accessible beach, with rock pools and snorkelling and diving opportunities. The site provides the opportunity to easily observe many species (e.g. snapper, moki, sting rays, blue cod and rock lobsters) even from the shore. This feature is considered the major attraction of the site.

In 2008, the Department of Conservation (DoC) commissioned Butcher Partners Limited to investigate the economic contribution of the Cape Rodney–Okakari Point (CROP) Marine Reserve at Leigh to the Rodney District economy (now Auckland).

Previously, in 2002, the Rodney Economic Development Trust (REDT) had made a study of the value of the marine reserve at Leigh. The result was a simple estimate of the amount spent by visitors (then 300,000 per year) to the marine reserve, placing the value to the local economy at $12.5 million per year at that time.[216]

12.2.1 Methodology

The methodology applied by DoC (2008) to value the CROP Marine Reserve is an economic impact analysis which, by only taking account of the market economic components, has a more limited scope than a social cost-benefit analysis, which would also include non-market components such as existence value.[217]

The focus of the study is the CROP's contribution to the local economy. Hence the study looks only at the economic impact of activities associated with the CROP Marine Reserve on the Rodney District. The study does not look at the protection and species conservation values or the non-recreation ecosystem services associated with the marine reserve. Nor does the study address the economic impact of the reserve on local recreational or inshore commercial fisheries.[218]

Despite the shortcomings of this approach, in the context of this research project, the fact that the methodology applied is 'purely' economic facilitates the comparison of the Reserve with most of the other values considered (e.g. aquaculture).[219] Moreover, since existence values are, at least partially,

[216] REDT, 2003.
[217] DoC, 2008, p. 5.
[218] DoC, 2008, p. 6.
[219] DoC, 2008, p. 6. 'An economic impact assessment will also allow results to be viewed in a broader context with other economic activities, such as fisheries, agriculture or total tourism in the district.'

already captured by other estimates (e.g. hedonic valuation of the premium on property values attributable to the Hauraki Gulf),[220] this prevents a double counting of some of those values.

The study calculated:

- output (total revenues)
- value added
- household income, and
- employment

based on:

- region visits – data was collected on the number of visitors and fees charged from the businesses with direct dependence on the marine reserve
- visitor spending questionnaires – a thousand surveys covering the spending of 3800 people, and
- visitor numbers – DoC installed a permanent vehicle-counter, the results from which were calibrated.

Choice of study area

The results of an economic impact analysis depend on the size of the area of study chosen, and the location in which the impacts are being measured. DoC (2008) considered the economic impact on Rodney District of activities rising in relation to the marine reserve. The choice of geographic boundary reflected what was believed to be the most relevant from the perspective of those who are interested in or concerned about the reserve, i.e. the impact on the local economy. The choice of study area plays a significant role in the final figures obtained. The economics of some systems studied may be such that the all the direct impacts occur within the study area. This is not the case for the marine reserve at Leigh, where many of the economic impacts associated with the marine reserve occur outside the Rodney District.

Multipliers

Direct spending by visitors, either while at the marine reserve or as a result of a trip to visit the marine reserve, has a flow-on or multiplier effect on the local economy. Multipliers for each category of visitor spending were calculated through an economic input-output model for Rodney District generated by Butcher Partners Limited:

> *The multipliers used for calculation of total output, value added (business and personal income), household income, and employment are shown in Table 48, and are Type II multipliers, i.e. they include the induced impacts of increased household spending as visitor spending at various businesses leads to increased household incomes in those businesses. These multipliers are applied to the net increase in visitor spending attributable to the marine reserve, where the net increase is estimated by asking visitors how likely they would have been to visit the area in the absence of the marine reserve, and how much longer or shorter their trip would have been in the absence of the marine reserve.*[221]

[220] See section 4.2 of this report which assesses the hedonic value of the Hauraki Gulf on properties.
[221] DoC, 2008, p. 10.

Table 48. Multipliers by sectors for Rodney District

	Output Multiplier	Value Added Spend Ratios		Household Income Spend Ratios		Employment Spend Ratios (FTEs/$m)	
		Direct	Total	Direct	Total	Direct	Total
Manufacturing	1.45	0.45	0.68	0.4	0.51	8.9	11.5
Retail Margins	1.58	0.53	0.85	0.46	0.61	14.1	17.7
Food / Restaurants	1.63	0.44	0.75	0.37	0.52	14.4	18
Accommodation	1.57	0.55	0.83	0.43	0.55	14.5	17.7
Activities	1.72	0.37	0.74	0.26	0.47	7.2	12.1

Source: DoC, 2008.

12.2.2 Value of the CROP Marine Reserve

DoC (2008) estimated that the Leigh Reserve received 375,000 visits in the year to 28 February 2008. In comparison, the Long Bay Marine Reserve, which lies inside the urban limits of Auckland, attracts upwards of 1,000,000 visits annually, with the attraction being primarily the beach and beach activities rather than the marine reserve (DoC, 2008).

The application of the economic multipliers calculated for the various industries to the estimated expenditure led to an estimation of the CROP Marine Reserve's total economic impacts on Rodney District in 2007. It was estimated that $18.6 million of total district output (total turnover, including purchases from suppliers) was dependent on the Reserve, as was $8.2 million of district business and personal income (value added), including $5.5 million of household income. The reserve created employment for 173 FTEs (full-time equivalents), including 10 jobs in marine-related activities that would otherwise not have been provided.

Values for the economic impact of the CROP Marine Reserve are summarised in Table 45 in $\$_{2011}$.

Table 49. Hauraki Gulf, economic impact assessment on the Rodney District of the Cape Rodney–Okakari Point Marine Reserve in 2007 (direct, indirect and induced impacts)

Total Output $\$_{2011}$million	9.2
Value Added GDP $2011million	6.2
Employment FTEs	432

Source: DoC, 2008.

An interesting observation made by the authors of DoC (2008) is that:

> *Crothers and McCormack (2008) estimated the local Leigh fishers would contribute to household incomes in the town approximately $800,000 per annum. Although the household income associated with the marine reserve was calculated for all of Rodney District, the value ($5.5 million) still implies a real shift in the focus of economic activity for the area from what was once primarily a fishing village. This shift in economic value creation away from resource extraction in favour of newer economic activities such as tourism is being seen at many levels from small communities (Collins, 2008; Gibbs, 2008; Orams, 2000) up to national levels. Crothers and McCormack (2008) record shrinkage in the Leigh-based fishing activity at a time when the tourism value for the Rodney District of the marine reserve is increasing. From an economic activity aspect the Rodney District appears to be better off for having the CROP marine reserve.*[222]

[222] DoC, 2008, p. 20.

13. Mining Sand in the Hauraki Gulf

13.1 Introduction

Coastal sand extraction (sea bead mining) is an important use of coastal resources in the Auckland region, with extraction occurring from both the Hauraki Gulf and Kaipara Harbour. Sand extraction has also occurred in the Waikato at several coastal locations in the past, but most of these operations have now stopped.[223] The only remaining sand mining in the Waikato region is on the west coast.[224]

Sand is primarily used as a fine aggregate in the production of concrete and asphalt for roading, concrete structures and other cement-based products. Sand is also extracted for use in drainage systems and for beach nourishment projects such as at Mission Bay, but this is generally a relatively minor share of the total.

In 2007 there were five coastal permits providing for sand extraction from the Auckland coastal marine area:

- Hauraki Gulf (near-shore, Pakiri): two permits totalling 76,000 cubic metres per year
- Hauraki Gulf (off-shore, east coast near Little Barrier Island): one permit for 2,000,000 cubic metres, with no annual limit but additional impact assessment requirements where quantities exceed 1,200,000 cubic metres in a 24-month period, and
- West Coast (Kaipara Harbour entrance, flood tidal delta): two permits totalling 400,000 cubic metres per year, for five years, then increasing quantities after meeting further conditions.

The availability of sea sand within the region is a significant economic benefit to the regional construction industry (and therefore to the regional economy as a whole), as the transport of sand from other parts of the country would increase the cost of roading and other infrastructural works such as wastewater drainage systems.

13.2 Methodology

In order to calculate the economic impact of sand mining, we need to know the value of its output, which corresponds to the regional economy's direct expenditure on sand, which in turn equals the quantity of sand times its market price.

The GDP impacts equal direct expenditure times GDP multipliers that reflect the direct value-added component of sand mining, plus the indirect and induced GDP impacts of the direct expenditure.

13.3 Results

Quantity: Auckland consumes around 400,000 cubic metres of sand per year,[225] of which 150,000 cubic metres per year is mined from the Hauraki Gulf and the remainder from the Kaipara Harbour.[226]

Price: The price of sand was estimated by Seafriends, a conservation organisation based at the Seafriends Marine Conservation and Education Centre at Leigh, as part of their submission in 2000

[223] A sand mine had operated at Whiritoa on the east coast of the Coromandel for 50 years, extracting 180,000 m^3 of sand, but is now closed down.
[224] At Taharoa, south of Kawhia Harbour, and at Maioro, near Port Waikato.
[225] 2007 data.
[226] ARC, 2007.

regarding a resource consent application. According to Seafriends, the price of quality sand for concrete comes close to NZ$25 per cubic metre.[227] In New Zealand the cost of one cubic metre of renourished sand (for beach replenishment) is about NZ$40. Given that beach replenishment is only a minor share of the total sand use in the region, we will use the $25 per cubic metre figure.

These figures are for the year 2000, so we should add cumulative inflation of around 30%. The current average price is then approximately $33 per cubic metre.

Expenditure: The direct expenditure value of sand mined in the Hauraki Gulf is therefore estimated as:

$$\text{Expenditure} = \$33/m^3 \times 150{,}000\ m^3 \text{ per year.} = \$5 \text{ million per year}$$

This is a somewhat rough estimate; the actual figure could well be as high as $10 million a year.

GDP: The GDP impact equals direct expenditure times the relevant GDP multiplier. GDP multipliers have not been calculated specifically for sand mining. However, given the relatively small scale of the industry, a high percentage margin of error will still only result in a small dollar variation.

Multipliers for the direct, indirect and induced GDP impacts of an activity are typically between 0.5 and 1.0. In the case of sand mining it could be similar or possibly even higher, given its importance to the regional economy and the higher cost of replacing it from elsewhere.

As an initial estimate, we will assume a GDP multiplier of 1.0, giving a total GDP impact of $5 to $10 million per year.

Employment: The largest employer in sand mining is McCallum Bros., who currently employ more than 60 people and supply sand to a number of the region's concrete plants.[228] Indirect and induced employment from sand mining is presumably of a similar order of magnitude, indicating a total employment impact of around 100 jobs.

13.4 Concluding Remarks

Sand mining is a tiny fraction of the Auckland economy, but plays an important role in other important sectors such as construction and transport. Sand from the Hauraki Gulf could be replaced by sand from elsewhere, but the cost (particularly transport) could be substantially higher in percentage terms – although probably not significant relative to the Auckland economy overall or even relative to other impacts of the Hauraki Gulf.

Although the local sand resource is non-renewable on human time frames, the current stock in Pakiri alone is 17 million cubic metres,[229] enough for the next 200 years at current extraction rates. Sand mining can have a variety of environmental impacts, not discussed here.

[227] Seafriends, 2000
[228] McCallum Bros., 2011
[229] Seafriends, 2000.

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Hauraki Gulf Total Economic Value Glossary

Alluvial - relating to or derived from alluvium.

Alluvium - a deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta.

Amenity - the qualities of a place that make it pleasant and attractive for individuals and communities.

Average Willingness To Pay (AWTP) – value to people of total consumption of a good (calculated on a per-unit basis); the maximum amount a person would be willing to pay (hypothetically; per unit) for a given total quantity of a good or service.

Benthic: relating to the flora and fauna found on the bottom of, or in the bottom sediments of, a sea or lake.

Biodiversity - the variety of life in a particular habitat or ecosystem including the totality of genes and species; variability among living organisms including within and between species (e.g. species richness) and within and between ecosystems (e.g. ecosystem complexity). (see also Ecosystem).

Biogenic - a substance produced by life processes. It may be either constituents, or secretions, of plants or animals.

Biomass - the total mass of living organisms in a given area or volume; recently dead plant material is often included as dead biomass.

Biota - the plant and animal life of a region.

Break bulk cargo - goods that must be loaded individually, and not in standard (20 foot or 40 foot) containers, nor in bulk as with oil or grain.

Bulk cargo - commodity cargo that is transported unpackaged in large quantities as a liquid or as a mass of relatively small solids (e.g. grain, coal).

Consumer surplus: the difference between a person's AWTP and what they actually pay (usually MWTP).

Contact recreation - any activity that involves coming in contact with water. Primary Contact recreation - where the body can be fully immersed and there is the potential to swallow water; includes surfing, water skiing, diving and swimming. Secondary Contact recreation - includes activities such as paddling, wading, boating and fishing in which there is direct contact but the chance of swallowing water is unlikely.

Cost benefit analysis (CBA) - a systematic process for calculating and comparing benefits and costs of a project, decision or government policy; both market and non-market impacts are expressed in monetary terms.

CO^2 Equivalent - the amount of a greenhouse gas (e.g. methane) needed to have the same greenhouse gas effect (warming of the earth's atmosphere) as a defined amount of carbon dioxide.

Ecological Function - the natural processes within an ecosystem that support life, e.g. the movement of water.

Ecosystems - a complex set of relationships between all living things such as plant, animal and micro-organism communities and their non-living environment including their interaction as a functional unit.

Ecosystem Goods and Services - the direct and indirect benefits that mankind receives or values from natural or semi-natural habitats; the benefits people obtain from the environment include goods (soil, food, animals, water, scenery) and services (functions such as water filtration, flood protection, pollination).

Employee count (EC): head count of salary and wage earners sourced from taxation data. This is mostly employees but can include a small number of working proprietors (who pay themselves a salary or wage).

Exclusive Economic Zone (EEZ) - a seazone over which a state has special rights over the exploration and use of marine resources; it stretches from the seaward edge of the state's territorial sea out to 200 nautical miles from its coast.

Extractive - an activity that removes a natural resource from the environment, which may be either renewable or non-renewable (e.g. fish or sand respectively) either in absolute terms or in human timeframes.

Fauna - animals, especially the animals particular to a region or period, considered as a group.

Fisheries management areas (FMAs) - The Quota Management System divides New Zealand's Exclusive Economic Zone into 10 FMAs.

Flora - plant life, especially the plants characteristic of a particular region or period, considered as a group.

Flow on effects – the indirect and induced economic impacts of an activity or expenditure.

Fluvial - of, relating to, inhabiting or found in a river or stream; produced by the action of a river or stream.

Full Time Equivalent Employees (FTE) – usually defined as the number of full-time employees plus half the number of part-time employees, where full-time is defined as working 30 hours or more per week. Sometimes calculated as **Full-Time Equivalent Employment (FTE) -** the number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs.

Greenhouse Gases (GHG) - water vapour (H2O), carbon dioxide (CO^2), nitrous oxide (NO), methane (CH4) and ozone (O3) are the primary greenhouse gases in the Earth's atmosphere. Also includes human-made gases such as the halocarbons and other chlorine- and bromine-containing substances. Due to their ability to absorb and emit light of a particular wavelength they contribute to the greenhouse gas effect, whereby more than the normal amount of atmospheric heat is retained in the atmosphere.

Gross Domestic Product (GDP) - the market value of all goods and services produced in a country or region in a given period i.e. subtracting the value of intermediate goods and services (imported and domestic) used in the production process, from the total value of sales.

Gross output – the total value of sales or turnover; the value of gross regional product plus intermediate consumption (imported and domestic).

Hedonic pricing – decomposing the price of an item into separate components that determine the price; often applied to variations in housing prices that reflect the economic values of local environmental attributes, in order to estimate values for ecosystem or environmental services that directly affect market prices (after correcting for house size, location and other factors).

Heritage - the legacy of tangible physical resources and intangible attributes that are inherited from past generations. Heritage includes historic heritage, natural heritage, taonga tuku iho (heirlooms) and other forms of heritage such as books, works of art, artefacts, beliefs, traditions, language and knowledge.

Heterogenous - diverse in kind or nature; composed of diverse or dissimilar parts; not homogenous or uniform.

Indirect impacts - net increase of economic activity generated by the provision of goods and services to the 'study sector'; impacts that arise as a consequence of an expenditure, through provision of goods and services for that expenditure.

Induced impacts - net increase of economic activity due to increased household expenditure in the 'study sector'; impacts of household expenditure that arise due to increased household incomes generated by the direct and indirect impacts of an expenditure.

Invasive and exclusive – (here used to mean) occupying a certain area and preventing other activities/benefits from being realised there.

Invertebrate - an animal without a backbone, such as insects, snails and starfish.

Kaimoana – seafood.

Kaitiakitanga – the process and practices of protecting and looking after the environment; sometimes translated as guardianship or stewardship.

Lentic Ecosystem - has still waters (from Latin lentus 'calm, slow'). Examples include: ponds, basin marshes, ditches, reservoirs, seeps, lakes, and vernal / ephemeral pools.

Lotic Ecosystem - has flowing waters. Examples include: creeks, streams, runs, rivers, springs, brooks and channels.

mana whenua – the right to exercise customary authority.

Marginal Willingness To Pay (WTP) – value to people of a small increase; willingness to pay money (hypothetically) in order to increase access or provision of a good or service by one more unit. Usually this equals its price or unit cost to the individual (unless the good is "lumpy").

Marine Protected Areas - areas of the marine environment especially dedicated to, or achieving through adequate protection, the maintenance and/or recovery of biological diversity at the habitat or ecosystem level in a healthy functioning state. They range from 'no-take' marine reserves to marine-protected areas that allow some extractive activities.

Multiplier: this captures the direct and indirect backward linkage effects associated with direct expenditures. It is summarised by the equation: (Direct Effect + Indirect Effect)/Direct Effect.

multi-criteria analysis (MCA) – a qualitative MCA compares impacts upon quadruple bottom line (QBL) categories and indicators, but applies expert knowledge and professional judgement for a robust ranking of effects, rather than numerical data.

Natural Character - those qualities and values of the coastal environment, wetlands, lakes, rivers and their margins that derive from the presence of natural elements, natural patterns and natural processes. These qualities include the presence of indigenous and exotic vegetation including pasture, terrestrial, aquatic and marine habitats, landforms, landscapes, and seascapes, the function of natural processes and the maintenance of water and air quality. The lower the degree of human modification the higher the level of natural character.

Natural Heritage - includes indigenous flora and fauna, terrestrial, marine and freshwater ecosystems and habitats, landscapes, landforms, geological features, soils and the natural character of the coastline.

Natural Resource Accounting - assessment of the value of natural resources, including their ecosystem services, for the purposes of measuring the full cost of decisions that affect these resources.

Output - total sales turnover, including purchases from suppliers (including imports).

POAL - Ports of Auckland Limited, the owner and operator of Auckland's main seaport, on the Waitemata, as well as a smaller seaport on the Manukau.

Portage - refers to the practice of carrying watercraft or cargo over land to avoid river obstacles, or between two bodies of water. A place where this carrying occurs is also called a portage.

Quadruple bottom line (QBL) - social, economic, environmental and cultural effects.

Quota management area (QMA) – a fisheries management area (FMA) or a grouping of FMAs for a given fish species and stock.

Quota management system (QMS) Under the QMS, commercial fishers now own individual perennial transferable quotas (ITQ); commercial catch limits (in tonnes) are set annually for each fish stock by the Minister of Fisheries, as total allowable commercial catch (TACC).

Renewable Energy - energy generated from solar, wind, hydro-electricity, geothermal, biomass, tidal, wave, or ocean current energy sources.

Sensitive Receiving Environments - areas where waste water overflows can undermine identified, important natural or human uses or values in marine, freshwater and terrestrial environments.

Terrestrial – land based.

Tangata whenua - the iwi or hapu that hold mana whenua (exercise customary authority) over an area.

TEU - twenty foot equivalent containers.

Total economic value (TEV) - the sum of all benefits derived by people from a resource; those include market and non-market values of use and non-use benefits (but this report focuses only on direct use values/activities).

Trophic dynamics - the interaction between species at different levels on the food web.

Type II multiplier – a multiplier that includes the induced impacts of increased household spending as spending at various businesses leads to increased household incomes in those businesses.

Unitary Plan - the Unitary Plan is Auckland Council's regulatory land-use planning document and prepared under the Resource Management Act 1991. The Unitary Plan will replace the existing district and some regional plans from the former city, district and regional councils. It will contain guidance and rules about how land can be developed and how resources can be used.

Willingness To Pay (WTP) - the maximum amount a person would be willing to pay, sacrifice or exchange in order to receive a good or to avoid something undesired, such as pollution. See also AWTP and MWTP.